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United States
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Agriculture

Soil
Conservation
Service

Cape May Court House,
New Jersey

1981 ANNUAL TECHNICAL REPORT OF THE CAPE MAY PLANT MATERIALS CENTER

(Serial)

A Summary of the North Atlantic Coastal Area Activities for 1981

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INTRODUCTION

This report covers the plant materials activities of the Cape May Plant Materials Center for the calendar year 1981. Established in 1965, the Cape May PMC is located approximately 24 miles south of Atlantic City, New Jersey on US Route 9. The property consists of 88 acres having soil types of Sassafras sandy loam and Downer loamy sand. Slopes are less than 1 percent. Elevation varies from 12 to 22 feet above sea level. Average precipitation is 41 inches. The mean annual temperatures are 62°F maximum and 44°F minimum. The climate is semi-humid and semi-maritime. The average growing season is 191 days and the plant hardiness zone is 7b.

The PMC serves the northeast coastal plain region extending from Cape Cod, Massachusetts to Cape Hatteras, North Carolina. The Major Land Resource Areas are the Northern Coastal Plain (149), a portion of the Atlantic Coastal Flatwoods (153) and the Southern Coastal Plains (133), north of the 35th parallel. Two plant materials specialists normally provide assistance for the coastal area served by the center. One is located in North Carolina and one in New Jersey. In the absence of the plant materials specialist in North Carolina, two plant science specialists act in that capacity. The states of North Carolina and Virginia are serviced out of Raleigh, North Carolina. The specialist located in Somerset, New Jersey provides plant materials guidance to the states of Delaware, Maryland, New Jersey, Connecticut, Massachusetts and Rhode Island. Operations of the center are conducted according to the Long Range Plan developed from the needs of the various states which the center serves.

Robert L. Hoover, Biological Technician, was promoted and transferred to the National PMC in Beltsville, Maryland effective June 28. This position was vacant for the remainder of the calendar year. Intermittent employees were used to handle the workload.

Dolores M. Eckert was hired as a trainee under the Young Adult Conservation Corps Program. Dolores was converted to Biological Aid at the Center because the permanent technician position remained vacant.

Philip L. Koch, a Soil Conservationist, was transferred to the Cape May PMC during the year. He had previously worked at the Benton Field Office in Benton, Arkansas. Phil is assigned to the PMC in a training position and will be learning the techniques, policies and procedures for all phases of the plant materials program.

The major problem in the area served by the Cape May PMC is the erosion of tidal streambanks. *Spartina patens* (saltmeadow cordgrass) and *S. alterniflora* (smooth cordgrass) are the two major species which occur naturally within and immediately above the tidal zone. They are logical choices to stabilize these areas. *S. patens* grows above the high tide elevation along the mid-Atlantic Coast. During 1976, an assembly of 78 accessions was collected and planted at the PMC to evaluate their performance. Four superior accessions have been selected for advanced evaluation and are growing on saline tidal stream banks in several states.

S. alterniflora grows in the intertidal zone of saline streams and like *S. patens* is well adapted to the Atlantic Coast. In the spring of 1977, 111 accessions were collected and planted on the PMC. Thirty of these accessions are currently being tested to determine their ability to perform satisfactorily on tidal stream bank areas.

Purpose and Objectives of the Cape May PMC

To develop and put into use new or improved plants for the conservation of soil, water and related resources. Develop sound culture methods and management techniques for the more effective use of plants and land.

Functions

-- Collects and initially evaluates new plant materials to include native collections, foreign plant introductions and strains from plant breeders.

-- Increases promising materials.

-- Makes advanced evaluations of selected accessions under simulated field conditions in comparison with a standard variety.

-- Determines cultural requirements of needed plant materials.

-- Makes field evaluation plantings on selected problem sites off the center, in order to obtain information on plants at sites typical of eventual use.

-- Provides seeds and plants for field plantings in soil and water conservation districts where final evaluation of a new plant is made.

-- Jointly names and releases new varieties or species with the New Jersey Agricultural Experiment Station.

-- After release, maintains and produces breeder or foundation seed or stock at the center in accordance with standards of the cooperating agency.

Note: Trade names used herein are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

PERSONNEL

Manager	Cluster R. Belcher
Assistant Manager	Donald W. Hamer
Soil Conservationist	Philip L. Koch (from October 5)
Foreman	Wilson J. Merrick
Biological Technician	Robert L. Hoover (until June 28)
Secretary	Barbara A. Turnier
Biological Aid (intermittent)	Dolores M. Eckert (from May 10)

In addition, several people worked at the PMC under the Young Adult Conservation Corps (YACC) and the Comprehensive Employment and Training Act (CETA) programs. These employees received special training in PMC field operations as well as plant material processing and seed cleaning techniques.

CAPE MAY PMC STATE CONSERVATIONISTS' ADVISORY COMMITTEE

Plater T. Campbell, NJ State Conservationist

Coy A. Garrett, NC STC

Manly S. Wilder, VA STC

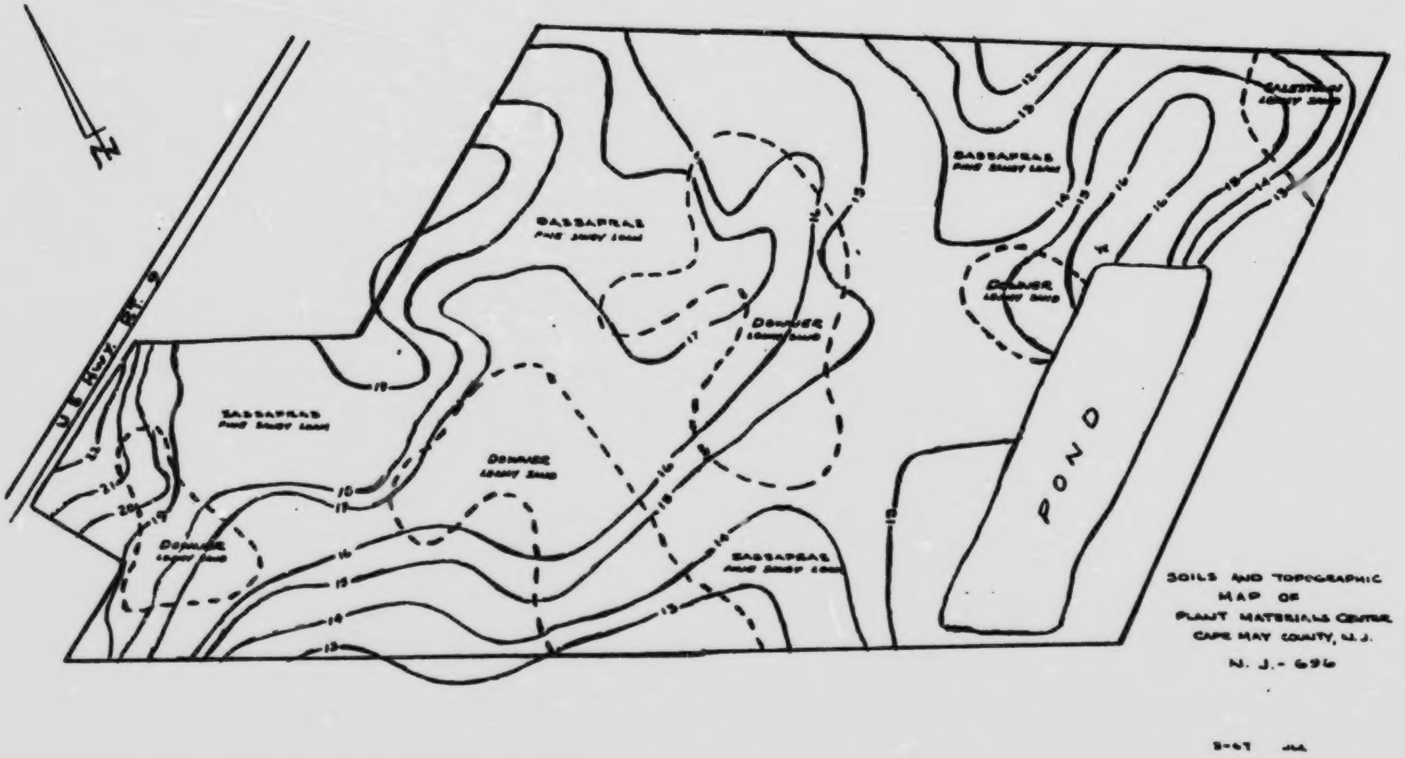
Obie D. Ashford, NJ State Resource Conservationist

W. Curtis Sharp, NETSC Plant Materials Specialist

Frank H. Webb, NJ Plant Materials Specialist

(Vacant), NC Plant Materials Specialist

CAPE MAY PLANT MATERIALS CENTER PROPERTY


N
U.S. HWY. RT. 9
SASSAFRAS FINE SANDY LOAM
DOWNER LOAMY SAND
GALESTOWN LOAMY SAND
POND
SOILS AND TOPOGRAPHIC
MAP OF
PLANT MATERIALS CENTER
CAPE MAY COUNTY, N.J.
N. J. - 696
3-47 JA

Soils and Elevation Map

Legend:

------ = Soil boundary.

15 = Elevation above sea level in feet.

Soils:

Sassafras - fine sandy loam

Downer - loamy sand

Galestown - loamy sand

Soil Descriptions

DOWNER LOAMY SAND, 0 to 5 percent slopes

Nearly level to gently sloping well-drained soils that have a loamy sand surface and sandy loam subsoil. Natural fertility and available water holding capacity is moderate. Permeability is moderately rapid. This soil is subject to severe wind erosion when exposed in fields. Irrigation is generally needed when growing vegetable crops.

GALESTOWN LOAMY SAND, 0 to 5 percent slopes

This nearly level to gently sloping well-drained soil has a thick sand surface soil exceeding 20 inches. It has a sandy loam subsoil. Natural fertility is low and available water capacity is moderate. Sandy surface is droughty. Permeability is rapid in the upper 2 ft. and moderate in the sandy loam subsoil.

SASSAFRAS SANDY LOAM, 0 to 2 percent slopes

Nearly level well-drained soils that have sandy loam surface soils and sandy clay loam subsoils. It has medium natural fertility. This soil has moderate permeability. This soil is subject to minor wind and water erosion. Irrigation is generally needed during extended dry periods.

Weather Records at Cape May Plant Materials Center for 1981

	Air Temperature °F						4" Soil Temperature °F						Precipitation			
1981	Maximum			Minimum			Maximum			Minimum			Total	Devi-	Grtst.	No.
Month	Ext.	Av.	Deviation	Deviation	Av.	Ext.	Ext.	Av.	Deviation	Deviation	Av.	Ext.	Inches	ation	Daily	Days
Jan.	53	36	-4	-5	18	-2	38	34	-5	-4	33	30	.42	-2.99	.21	5
Feb.	65	46	+5	+3	27	6	51	41	+2	+2	39	34	3.48	+0.20	.66	12
March	71	49	-1	+2	31	19	51	45	-2	-1	41	28	1.79	-1.37	.73	6
April	86	64	+4	+3	44	26	65	57	+1	+2	53	49	5.14	+2.15	1.46	15
May	86	70	+2	+1	51	32	74	66	0	+1	61	57	2.97	-0.75	.93	14
June	93	81	+4	+2	62	51	81	77	+1	+3	73	67	4.97	+1.54	1.00	16
July	95	86	+3	+2	66	52	85	81	-1	+2	78	74	1.80	-1.05	.88	8
Aug.	91	81	-2	-4	61	50	82	78	-3	-1	75	71	3.29	-0.82	1.18	9
Sept.	91	77	0	0	58	40	79	74	-2	0	71	65	1.53	-1.11	.83	7
Oct.	80	64	-1	-1	45	28	69	62	-2	-2	59	54	2.78	-0.86	1.28	11
Nov.	68	55	+4	0	38	21	59	53	-1	-1	50	43	1.47	-1.82	.77	5
Dec.	63	45	-1	+3	31	11	48	42	-3	-2	40	36	3.53	-0.60	1.08	11
1981	95	63			44	-2	85	59			56	28	33.17	-6.49	1.46	119
Normal*		62			44			60			56		41			

*Normal based on:

16 yr. Air Temperature Average; 12 yr. Soil Temperature Average; 16 yr. Precipitation Ave.

Frost free days 165 - May 8 to October 20, 1981 - Normal 191 days.

1.25 inches of snow were measured; this fell on January 2 and March 6.

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RELEASE OF 'ATLANTIC' COASTAL PANICGRASS

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AND THE
NEW JERSEY AGRICULTURAL EXPERIMENT STATION

The United States Department of Agriculture, Soil Conservation Service and the New Jersey Agricultural Experiment Station announce the release of 'Atlantic' coastal panicgrass (Panicum amarum var. amarulum (Hitchc. and Chase) P. G. Palmer.

Atlantic is characterized by good seedling vigor (intermediate between weeping lovegrass and switchgrass), uniform growth and reliable seed production under cultivation. The strain is typical of the species in regard to leafiness, height and culm size. The plants are not seriously affected by disease or insects. Atlantic was selected as being more rust tolerant than other vigorous strains of the species. It has the ability to remain upright through much of the winter, even during periods of moderate snow cover.

Atlantic and other coastal panicgrass strains have been screened at the Cape May Plant Materials Center. In a 1968 planting of 17 strains, Atlantic was clearly more vigorous than 10 of these and none of the other six were superior. Atlantic has been evaluated in field sized plantings along the Atlantic and Gulf Coasts from Massachusetts to Texas.

Atlantic will perform satisfactorily on acid, sandy, droughty, infertile soils and on heavy, imperfectly drained soils. It will not tolerate large quantities of sand accretion as well as American beachgrass such as 'Cape'. Atlantic is somewhat tolerant of salt spray and salty soils. Its natural range of adaptation is the coastal areas from Massachusetts to Texas. It has been grown successfully in Pennsylvania, Ohio and much of the Northern and Southern Piedmont in test plantings on drastically disturbed sites.

Coastal panicgrass was first considered as a conservation plant because it could be established by direct seeding on coastal dunes. It can be seeded on surface mined areas, sanitary landfills, dredged spoil and similar disturbed sites. Its range of adaptation to difficult sites, tolerance to problem soils and robust growth characteristics appear to make it a useful plant for other conservation purposes. The resistance of the stems to lodging and its seed production enhance its value as feed and cover for wildlife.

Breeder seed will be maintained and distributed by the Cape May Plant Materials Center.

Release of 'Atlantic' Coastal Panicgrass

'Atlantic' coastal panicgrass, Panicum amarum var. amarulum (Hitchc. & Chase) P. G. Palmer, is a native warm season cultivar developed by the USDA Soil Conservation Service.

The field collection was made in 1955 at the USDI Back Bay Wildlife Refuge near Princess Anne, Virginia. It was brought to the Beltsville, Maryland Plant Materials Center and designated as BN-8360. In 1960, using source material, a planting of BN-8360 was established as an initial increase block. In 1965, using seed produced at Beltsville, a seed production field was established at Cape May, New Jersey. The number NJ-49 was assigned to this accession. In 1979, NJ-49 was numbered PI-421136.

Atlantic is characterized by strong seedling vigor, uniform growth and reliable seed production under cultivation. The strain is typical of the species in regard to leafiness, height and culm size. The plants are not adversely affected by disease or insects. It has the ability to remain upright through much of the winter, even during periods of moderate snow cover.

Atlantic and other coastal panicgrass strains have been screened at the Cape May Plant Materials Center. In a 1968 planting of 17 strains, Atlantic was clearly more vigorous than 10 of these and none of the other six were superior. Atlantic has been used in field sized plantings along the Atlantic and Gulf Coasts from Massachusetts to Texas.

Atlantic will perform satisfactorily on sandy, droughty, infertile soils and thrive on deep fertile loams. It will grow on heavy, imperfectly drained soils. It will not tolerate large quantities of sand accretion. Atlantic is somewhat tolerant of salt spray and salty soils. Its natural range of adaptation is the coastal areas from Massachusetts to Texas. It has been grown successfully in Pennsylvania, Ohio and much of the Northern and Southern Piedmont.

Coastal panicgrass was first considered as a conservation plant because it could be direct seeded on coastal dunes. Its range of adaptation, tolerance to droughty infertile sites, and growth characteristics make it a useful plant for other conservation purposes. The resistance of the stems to lodging, and the quantity of forage and seed production enhances its wildlife value. It can also be seeded on surface mined areas, sanitary landfills, dredged spoil and similar disturbed sites.

The production field at the Cape May PMC will supply breeder seed that will be maintained and distributed by the Cape May PMC.

INITIAL EVALUATIONS

Spartina alterniflora for Tidal Bank Stabilization

34I001F

Coastal sound banks and river estuaries which are exposed to storms and tidal action have become a severe conservation problem along the mid-Atlantic coastal region. The problem is extremely acute in the states of Virginia, North Carolina and Maryland and to a lesser extent in Delaware and New Jersey. The Soil Conservation Service has recognized shore erosion as a critical problem for many years. Previous efforts were mainly directed towards engineering structures and transplanting native cordgrasses from nearby marshes along eroding tidal areas.

In 1975, the shore erosion problem was designated as a high priority item for the service area of the Cape May PMC. The planned action was to be limited to saline waters and was divided into two phases; these being the stabilization of the intertidal zone and the vegetation of the beach area above the tidal zone.

Spartina patens (saltmeadow cordgrass) is the dominant grass that grows immediately above the high tide elevation along the mid-Atlantic coast. Since the area adjacent to the high tide line is the critical space to stabilize, the first priority was to develop a plant for use above the intertidal zone. An assembly of S. patens was collected in 1975 and 1976 with the initial evaluations being conducted during 1976 and 1977.

S. alterniflora (smooth cordgrass) is the only grass species that has potential for stabilizing the intertidal zone of saline waters along the mid-Atlantic coast. To supplement the use of S. patens, an assembly of S. alterniflora was started in 1977 and completed during the spring of 1978. In the spring of 1977, 111 accessions were planted on the PMC. These were planted in a simulated tidal basin excavated in a permeable soil. The plants were flooded twice each week during the summer. The plant growth was rated fair to good in the shallow basin despite the lack of normal tidal cycles of saline water. Only 102 accessions survived by late fall.

Normally, S. alterniflora grows in the intertidal zone of saline waters where the grass is subjected to two tidal cycles each day. The conditions are difficult to simulate on an inland site. The available natural sites were either covered with native plants or lacked the security offered at a PMC site.

The basin could not be flooded during the winter which resulted in excessive loss from dessication and cold temperatures. Only 70 accessions survived the first winter with adequate planting stock for evaluation. Seven additional accessions were added to the planting, bringing the total number to 77.

These 77 accessions were replanted in a shallow pit in June, 1978. The pit was flooded two to three times each week during the summer. The flooded depth was about 0.1 to 0.2 meters. Since this soil was less permeable than the soil in the 1977 holding pit, a drainage pipe was installed. The flooded period was maintained for 12 to 24 hours resulting in a tidal cycle of one to three days. A complete analysis fertilizer was broadcast over the rows each month to stimulate growth. Fresh water was used to flood the basin and no salt was applied to the soil or water. Growth was excellent.

In the spring of 1980, several inferior accessions were eliminated reducing the number to 40. The eliminated accessions were discarded based on their inability to compete with others for stem density, rhizome spread, vigor, winter hardiness, etc.

An additional basin-type planting area was constructed in early 1981 to expedite the evaluation and selection process for S. alterniflora. Both plantings were evaluated during 1981 and based upon the results, 30 of the 40 accessions were selected for further testing in 1982.

S. alterniflora can be grown successfully under a simulated tidal condition by flooding the plants with fresh water during the summer. Occasional flooding during the dormant season appears to increase the winter survival rate. The use of salt or saline water does not appear necessary, but plants grown in fresh water do require hardening in salt water prior to outplanting on a saline site. Frequent and high rates of fertilizer definitely stimulate growth when planted on artificial sites. The use of fungicides during late summer and early fall seemed to increase the winter survival rate.

The objective of this project is to select a vigorous, hardy strain of S. alterniflora to plant on the tidal banks of saline streams.

Table 1

Regrowth and plant residue for Spartina alterniflora following first winter, 1981[1]

PI Number	Regrowth[2]	Plant Residue[3]	PI Number	Regrowth	Plant Residue
421162		F	421185	Yes	S
421184		Mo	421187		S
421166		F	421224	Yes	Mo
421163		Mo	421172		F
421195		F	421230	Yes	Mo
421144		Mo	421169		F
421220		S	421232		S
421221		Mo	421208		Mu
421190		Mo	421175	Yes	S
T-02804	Yes	F	421145		F
421146		N	421198		F
421228		Mu	421203		F
421210	Yes	F	421154		S
421153		Mu	421192		S
T-02808	Yes	Mu	421188		F
421167	Yes	S	421231		F
421159		S	421202		F
421140		Mo	T-02809		Mo
421199		F	421219		Mo
421200		F	T-02816		Mu

---

[1] 15 culms planted per row on June 3, 1980; data recorded April 8.

[2] Presence of active green regrowth.

[3] Amount and quality of plant residue - N=None present; S=Very little and prostrate; F=Moderate amount but prostrate; Mo=Moderate amount with some upright stems; Mu=Much residue and most of it upright.

Table 2

Flowering dates for Spartina alterniflora during second year, 1981[1]

PI No.	7/13[2]	8/19	8/26	8/31	9/8	9/14	9/28
421162	-	-	-	Y	Y	Y	Y
421184	-	Y	Y	Y	Y	Y	Y
421166	-	Y	Y	Y	Y	Y	Y
421163	-	Y	-	-	Y	Y	Y
421195	Y	Y	Y	Y	Y	Y	Y
421144	-	-	-	-	Y	Y	Y
421220	-	-	-	Y	Y	Y	Y
421221	-	-	-	-	Y	Y	Y
421190	Y	Y	Y	Y	Y	Y	Y
T02804	-	Y	Y	Y	Y	Y	Y
421146	-	-	-	-	-	-	-
421228	-	Y	Y	Y	Y	Y	Y
421210	-	-	-	-	-	-	Y
421153	-	-	-	-	Y	Y	Y
T02808	-	Y	Y	Y	Y	Y	Y
421167	-	Y	Y	Y	Y	Y	Y
421159	-	-	Y	Y	Y	Y	Y
421140	-	-	-	-	-	-	Y
421199	-	Y	Y	Y	Y	Y	Y
421200	-	Y	Y	Y	Y	Y	Y
421185	-	Y	Y	Y	Y	Y	Y
421187	-	Y	Y	Y	Y	Y	Y
421224	-	Y	Y	Y	Y	Y	Y
421172	-	Y	Y	Y	Y	Y	Y
421230	-	Y	Y	Y	Y	Y	Y
421169	-	-	Y	Y	Y	Y	Y
421232	-	Y	Y	Y	Y	Y	Y
421208	-	-	-	-	Y	Y	Y
421175	Y	Y	Y	Y	Y	Y	Y
421145	-	-	-	-	-	Y	Y
421198	-	Y	Y	Y	Y	Y	Y
421203	-	Y	Y	Y	Y	Y	-
421154	-	-	-	-	-	-	-
421192	-	-	-	-	-	-	-
421188	Y	Y	Y	Y	Y	Y	Y

Table 2
(cont.)

Flowering dates for *Spartina alterniflora* during second year, 1981

PI No.	7/13	8/19	8/26	8/31	9/8	9/14	9/28
421231	-	-	-	-	-	-	-
421202	-	-	-	-	-	-	-
T02809	-	-	-	-	-	-	-
421219	-	Y	Y	Y	Y	Y	Y
T02816	-	-	-	Y	Y	Y	Y

1/15 culms planted per row on June 3, 1980.

2/Ratings: - = Plant not in anthesis; Y=Plants in flower stage.

Table 3

Relative amount of new growth for *Spartina alterniflora*, 1981[1]

PI No.	4-16[2]	4-28	5-8	5-13	5-20	PI No.	4-16	4-28	5-8	5-13	5-20
421162	7	6	5	5	7	421185	7	5	5	8	9
421184	7	5	4	6	8	421187	7	4	4	7	8
421166	6	3	2	4	4	421224	7	5	5	6	8
421163	5	3	2	3	3	421172	8	5	5	8	9
421195	6	6	5	7	8	421230	6	3	3	5	5
421144	9	7	6	8	9	421169	4	3	3	5	5
421220	7	7	7	9	9	421232	9	5	5	8	8
421221	5	4	3	5	5	421208	9	7	7	9	9
421190	5	5	4	6	7	421175	8	5	5	9	9
T02804	5	5	5	6	7	421145	10	9	8	9	9
421146	10	10	10	10	10	421198	6	5	5	8	8
421228	6	4	4	5	6	421203	7	5	5	8	8
421210	4	3	3	6	8	421154	10	10	10	10	10
421153	7	4	4	6	7	421192	9	9	9	10	10
T02808	6	4	3	5	5	421188	9	8	7	9	9
421167	6	4	4	7	7	421231	10	9	9	9	9
421159	10	9	9	9	9	421202	10	10	10	10	10
421140	9	8	8	9	9	T02809	10	10	10	10	10
421199	8	7	7	9	9	421219	9	6	6	9	9
421200	8	5	4	7	8	T02816	8	5	4	6	6

---

[1] 15 culms planted per row on June 3, 1980.

[2] Relative amount of growth: 1=Excellent; 3=Good; 5=Fair; 7=Little; 9=Very Little; 10=None.

Table 4

Injury and vigor on three dates for Spartina alterniflora, 1981[1]

PI No.	Injury[2]			Vigor[3]	
	Disease		Insect		
	7-13	8-19	8-19	6-12	7-13
421162	1	3	1	4	3
421184	1	1	1	5	3
421166	1	3	1	3	2
421163	2	5	2	2	2
421195	2	2	1	5	3
421144	1	1	1	6	2
421220	1	1	1	6	4
421221	2	1	1	3	3
421190	3	5	2	4	3
T02804	1	1	1	5	3
421146	1	-	-	-	-
421228	1	1	3	4	2
421210	1	1	1	4	3
421153	1	3	2	5	3
T02808	1	3	1	3	2
421167	1	1	2	4	2
421159	1	1	2	9	5
421140	1	1	1	8	5
421199	1	3	1	7	3
421200	1	5	3	6	2
421185	3	3	3	6	2
421187	1	3	2	6	2
421224	1	1	1	6	3
421172	2	1	1	6	3
421230	1	1	1	5	3
421169	1	1	1	5	2
421232	1	1	1	5	2
421208	1	1	1	5	2
421175	1	1	1	7	4
421145	1	1	1	7	4
421198	1	1	1	6	2
421203	1	1	1	8	4
421154	1	-	-	-	-
421192	1	3	1	9	4
421188	1	1	1	7	3

Table 4
(cont.)

Injury and vigor on three dates for *Spartina alterniflora*, 1981

PI No.	Injury				Vigor	
	Disease		Insect			
	7-13	8-19	8-19		6-12	7-13
421231	1	1	1		9	2
421202	1	-	-		-	4
T02809	1	1	1		-	3
421219	1	1	2		7	-
T02816	1	1	1		3	6

1/15 culms planted per accession on June 3, 1980.

2/Injury - 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=No rating.

3/Vigor: Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; - = No rating.

Table 5

Plant dimensions for two-year-old Spartina alterniflora, 1981[1/]

PI No.	Head Height (cm)[2/]	Leaf Height (cm)	Plant Width (cm)	Rhizome Spread (cm)
421162	70*	65	100	210
421184	100	70	70	110
421166	75*	50	130	240
421163	115*	70	120	210
421195	105	80	80	140
421144	115*	65	45	120
421220	80*	45	40	50
421221	120*	75	100	210
421190	100	75	65	110
T02804	100	75	65	110
421146	-	-	-	-
421228	90	75	85	170
421210	45*	45	75	215
421153	120*	90	70	120
T02808	110	110	70	160
421167	80	70	80	150
421159	85*	60	50	110
421140	60*	40	60	100
421199	80	60	50	80
421200	110	90	80	140
421185	110	90	50	110
421187	110	80	61	100
421224	110	95	65	100
421172	80	75	60	100
421230	110	100	80	110
421169	85*	40	85	170
421232	100	80	50	80
421208	100*	60	40	75
421175	60	50	45	100
421145	125*	75	40	60
421198	85	70	50	120
421203	80	60	40	85
421154	-	-	-	-
421192	-	-	-	40
421188	90	80	55	100

Table 5
(cont.)

Plant dimensions for two-year-old Spartina alterniflora, 1981

PI No.	Head Height (cm)	Leaf Height (cm)	Plant Width (cm)	Rhizome Spread (cm)
421231	-	-	-	-
421202	-	-	-	-
T02809	-	-	-	-
421219	100	80	40	70
T02816	135*	100	70	120

1/15 culms planted per accession on June 3, 1980; data recorded August 17.

2/* = Late maturing accessions were measured after August 17.

Table 6

Stand rating and stem density for forty *Spartina alterniflora* accessions, 1981[1]

PI No.	Stand[2]	Stem Density[3]		
		No.	No.	Average
421162	4	35	31	33
421184	3	31	33	32
421166	1	39	41	40
421163	2	17	17	17
421195	5	18	20	19
421144	5	15	17	16
421220	5	29	32	31
421221	3	17	25	21
421190	6	22	19	21
T02804	4	37	29	33
421146	9	0	0	0
421228	3	33	26	30
421210	3	28	20	24
421153	5	25	31	28
T02808	3	16	24	20
421167	3	24	23	24
421159	8	15	22	19
421140	7	17	23	20
421199	6	31	28	30
421200	4	19	16	18
421185	5	33	17	25
421187	4	22	21	22
421224	6	32	28	30
421172	4	19	25	27
421230	2	37	28	33
421169	2	26	33	30
421232	4	31	27	29
421208	3	34	43	39
421175	5	33	26	30
421145	8	7	12	10
421198	6	8	5	7
421203	5	0	0	0
421154	9	0	0	0
421192	9	18	19	19
421188	7	22	16	19

Table 6
(cont.)

Stand rating and stem density for forty *Spartina alterniflora* accessions, 1981[1/]

PI No.	Stand	Stem Density		
		No.	No.	Average
421231	8	16	8	12
421202	9	0	0	0
T02809	9	0	0	0
421219	7	15	15	15
T02816	3	2	29	16

1/15 culms planted per accession on June 3, 1980.

2/Stand rating recorded August 19; Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Hill Nos. 3 and 9 were counted. These numbers represent the number of culms growing in a 30 cm x 30 cm area centered over the row on September 14.

Table 7

Dry root and stem weights for Spartina alterniflora, 1981[1]

PI No.	Hill No.	Stem Weight (gm)	Root Weight (gm)	PI No.	Hill No.	Stem Weight (gm)	Root Weight (gm)
421221	3	103	43	421203	3	44	23
421221	9	100	44	421203	9	48	14
T-2816	3	70	33	421140	3	23	12
T-2816	9	187	43	421140	5	21	16
421224	3	75	42	421167	3	39	18
421224	9	12	6	421167	9	28	12
421219	3	51	18	421195	3	13	12
421219	5	30	16	421195	9	9	5
421153	3	109	32	421199	3	21	9
421153	9	38	22	421199	9	20	10
T-2808	3	57	16	421159	3	1	1
T-2808	9	112	40	421159	9	18	10
421200	3	61	32	421175	3	23	14
421200	9	34	25	421175	9	16	11
421208	3	181	53	421172	3	23	7
421208	9	82	35	421172	9	69	39
421220	3	85	41	T-2804	3	83	59
421220	9	13	6	T-2804	9	102	46
421232	3	45	23	421188	3	22	10
421232	9	47	25	421188	9	4	2
421166	3	33	36	421162	3	129	78
421166	9	40	36	421162	9	87	38
421169	3	78	58	421144	3	98	28
421169	9	77	41	421144	9	72	21
421184	3	47	16	421185	3	87	37
421184	9	40	16	421185	9	9	12
421163	3	55	15	421190	3	85	39
421163	9	62	25	421190	9	69	22
421228	3	49	25	421230	3	69	38
421228	9	65	42	421230	9	38	33
421187	3	33	32	421145	5	22	15
421187	9	38	12	421145	9	14	8
421210	3	34	16	421198	5	16	12
421210	9	75	39	421198	10	30	39

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[1] Planted June 3, 1980; root weights recorded October 19 and 20; stem weights recorded November 25.

Table 8

Transition of Spartina alternfilora foliage into dormancy, 1981[1/]

PI No.	Dates								
	10/14[2/]	10/20	10/28	11/4	11/10	11/18	11/25	12/1	12/9
421162	15	30	40	40	50	60	85	90	95
421184	15	20	25	40	55	70	90	95	100
421166	20	25	40	55	65	85	95	100	100
421163	30	30	30	55	65	80	95	95	95
421195	35	35	35	50	80	85	95	100	100
421144	15	15	15	25	40	50	70	85	95
421220	15	25	40	50	55	95	100	100	100
421221	10	15	15	35	45	60	80	85	95
421190	20	30	40	45	50	65	85	90	100
T-2804	15	20	25	40	55	65	90	95	100
421146	-	-	-	-	-	-	-	-	-
421228	20	20	20	30	30	55	80	85	95
421210	10	10	10	20	25	45	50	75	90
421153	25	30	30	50	50	70	80	90	95
T-2808	15	20	30	55	55	65	80	85	90
421167	10	15	20	40	40	55	85	95	100
421159	30	40	65	90	90	95	100	100	100
421140	10	10	15	30	40	60	90	95	95
421199	10	10	10	20	30	45	50	65	85
421200	20	35	50	70	85	90	95	95	100
421185	25	50	90	90	95	95	100	100	100
421187	15	25	50	50	75	90	95	100	100
421224	20	35	45	55	75	90	95	95	100
421172	20	25	40	60	65	90	95	100	100
421230	15	35	35	60	60	85	95	100	100
421169	20	25	50	55	75	95	95	100	100
421232	30	30	45	60	75	90	95	100	100
421208	10	40	40	45	65	85	95	95	100
421175	30	30	30	40	65	95	100	100	100
421145	10	15	15	25	35	50	75	75	95
421198	10	15	20	30	35	55	80	80	90
421203	10	20	20	30	40	60	75	85	95
421154	-	-	-	-	-	-	-	-	-
421192	20	20	20	35	40	80	90	90	100
421188	15	15	15	40	45	65	90	90	95

Table 8
(cont.)

Transition of *Spartina alterniflora* foliage into dormancy, 1981

PI No.	Dates								
	10/14	10/20	10/28	11/4	11/10	11/18	11/25	12/1	12/9
421231	10	40	40	45	55	70	95	95	95
421202	-	-	-	-	-	-	-	-	-
T-2809	10	20	25	35	45	85	100	100	100
421219	10	15	15	30	40	55	60	65	95
T-2816	10	15	30	35	45	55	65	65	95

1/Planted June 3, 1980.

2/Values given are percent dormancy; (i.e. percent of plant is brown or yellow).

Table 9

Characteristics for 40 *Spartina alterniflora* accessions, 1981[1]

PI No.	Survival (No.)	Vigor[2]	PI No.	Survival (No.)	Vigor
421219	15	2	421190	15	1
421162	15	3	421192	7	5
421163	15	3	421166	15	2
421220	15	3	421167	15	3
421202	14	2	421159	13	4
421145	9	7	421175	15	1
421154	15	6	421185	15	2
421195	15	4	421228	15	2
T02809	9	7	T02804	15	3
421184	15	2	421231	11	4
421200	15	3	421208	15	1
421187	15	3	421199	15	1
T02816	15	3	421172	15	3
421230	13	4	421144	15	3
421232	15	4	421169	15	2
421188	15	2	421210	15	2
421140	15	3	T02808	15	2
421153	15	3	421224	15	3
421146	10	6	421198	15	3
421203	15	3	421221	15	2

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[1] 15 culms/accession established May 27-June 12 in south pit except for PI-421146 and PI-421231 = 12 culms; data recorded July 13.

[2] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 10

Injury and amount of growth for 40 *Spartina alterniflora* accessions, 1981[1]

PI No.	Injury		Amount of Growth [3]
	Insect [2]	Disease [2]	
421219	1	1	2
421162	1	1	4
421163	1	1	3
421220	1	1	2
421202	1	1	3
421145	1	1	8
421154	1	1	7
421195	1	1	4
T-2809	1	1	5
421184	1	1	1
421200	1	1	3
421187	1	1	3
T-2816	1	1	2
421230	1	1	4
421232	1	1	4
421188	1	1	3
421140	2	1	2
421153	2	3	3
421146	1	1	5
421203	1	1	4
421190	3	7	2
421192	2	5	4
421166	1	3	2
421167	1	1	3
421159	1	1	5
421175	1	1	3
421185	1	1	1
421228	1	1	3
T-2804	1	1	3
421231	1	1	4
421208	1	1	3
421199	1	1	4
421172	1	1	2
421144	1	1	2
421169	1	1	3

Table 10
(cont.)
Injury and amount of growth for 40 *Spartina alterniflora* accessions, 1981

PI No.	Injury		Amount of Growth
	Insect	Disease	
421210	1	3	3
T-2808	2	3	1
421224	3	2	2
421198	1	1	3
421221	1	1	2

1/15 culms/accession established May 27-June 12 in south pit; data recorded August 19.

2/Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Dying plants.

3/Relative ratings: 1=Excellent; 3=Good 5=Fair; 7=Poor; 9=Very Poor.

Table 11

Dimensions for 40 *Spartina alterniflora* accessions, 1981[1]

PI No.	Width (cm)	Height (cm) Leaf	Height (cm) Head	Date[2]
421219	30	90	120	8-17
421162	20	50	90	8-31
421163	30	75	100	8-31
421220	35	75	110	8-31
421202	30	80	110	8-31
421145	10	25	70	9-14
421154	10	30	70	9-8
421195	30	60	75	8-17
T02809	20	50	115	9-14
421184	35	90	110	8-17
421200	30	70	80	8-17
421187	20	55	90	8-17
T02816	30	100	120	8-31
421230	20	75	90	8-17
421232	20	55	70	8-17
421188	30	70	85	8-17
421140	30	60	100	9-28
421153	30	80	100	8-31
421146	15	70	75	8-31
421203	20	60	80	8-17
421190	35	85	110	8-17
421192	25	50	70	8-17
421166	25	60	75	8-17
421167	25	75	85	8-17
421159	15	60	75	8-31
421175	35	65	85	8-17
421185	35	70	100	8-17
421228	40	80	100	8-17
T02804	25	80	95	8-17
421231	25	70	80	8-17
421208	30	90	140	9-8
421199	20	60	100	8-31
421172	25	80	90	8-17
421144	25	70	130	9-14
421169	20	60	75	8-31

Table 11
(cont.)

Dimensions for 40 Spartina alterniflora accessions, 1981

PI No.	Width (cm)	Height Leaf (cm)	Height Head (cm)	Date
421210	20	40	80	9-8
T02808	25	90	125	8-31
421224	25	85	100	8-17
421198	20	70	75	8-17
421221	35	80	120	9-8

1/15 culms/accession established May 27-June 12 in south pit, Cape May PMC.

2/Date head heights were measured. All other data (i.e. width and leaf height) recorded August 17.

Table 12

Flowering dates for 40 *Spartina alterniflora* accessions, 1981[1]

PI No.	Dates						
	7-13	8-19	8-26	8-31	9-8	9-14	9-28
421219		X[2]	X	X	X	X	X
421162			X	X	X	X	X
421163				X	X	X	X
421220			X	X	X	X	X
421202		X	X	X	X	X	X
421145						X	X
421154					X	X	X
421195	X	X	X	X	X	X	X
T-2809						X	X
421184		X	X	X	X	X	X
421200		X	X	X	X	X	X
421187		X	X	X	X	X	X
T-2816				X	X	X	X
421230		X	X	X	X	X	X
421232		X	X	X	X	X	X
421188	X	X	X	X	X	X	X
421140							X
421153				X	X	X	X
421146				X	X	X	X
421203		X	X	X	X	X	X
421190	X	X	X	X	X	X	X
421192		X	X	X	X	X	X
421166		X	X	X	X	X	X
421167		X	X	X	X	X	X
421159			X	X	X	X	X
421175	X	X	X	X	X	X	X
421185		X	X	X	X	X	X
421228		X	X	X	X	X	X
T-2804		X	X	X	X	X	X
421231		X	X	X	X	X	X
421208					X	X	X
421199		X	X	X	X	X	X
421172	X	X	X	X	X	X	X
421144						X	X
421169			X	X	X	X	X

Table 12
(cont.)

Flowering dates for 40 Spartina alterniflora accessions, 1981

PI No.	Dates						
	7-13	8-19	8-26	8-31	9-8	9-14	9-28
421210					X	X	X
T-2808		X	X	X	X	X	X
421224		X	X	X	X	X	X
421198		X	X	X	X	X	X
421221					X	X	X

1/15 culms/accession established May 27-June 12 in south pit.

2/Rating: X=2 or more plants actively flowering.

Table 13

Transition of Spartina alterniflora foliage into dormancy, 1981[1/]

PI No.	Dates												
	10/14[2/]	10/20	10/28	11/4	11/10	11/18	11/25	12/1	12/9	12/17	12/23	12/28	1/7/82
421219	10	15	15	30	40	50	60	60	90	90	95	95	95
421162	15	40	40	60	60	80	85	85	95	95	100	100	100
421163	15	25	25	40	45	55	70	70	90	95	95	95	95
421220	10	25	40	50	50	65	90	90	95	100	100	100	100
421202	20	40	45	60	70	85	95	95	95	100	100	100	100
421145	10	15	15	30	40	60	90	90	95	95	95	95	100
421154	15	25	45	45	60	90	95	95	100	100	100	100	100
421195	10	30	40	45	50	75	95	95	100	100	100	100	100
T-2809	10	20	35	40	50	80	95	100	100	100	100	100	100
421184	15	30	45	55	55	70	95	95	100	100	100	100	100
421200	15	30	30	45	50	55	80	80	95	95	95	100	100
421187	10	20	20	45	45	60	90	90	95	95	100	100	100
T-2816	10	15	15	35	35	50	75	75	90	95	95	95	100
421230	20	40	40	50	55	75	95	95	100	100	100	100	100
421232	10	25	30	40	40	70	95	95	100	100	100	100	100
421188	20	30	30	50	50	50	80	80	90	95	100	100	100
421140	10	10	10	20	20	45	65	75	95	95	95	95	95
421153	15	20	20	45	45	55	90	90	95	95	95	95	95
421146	10	15	15	30	30	45	80	80	95	95	95	100	100
421203	20	35	35	40	50	55	85	85	95	95	95	95	95
421190	35	55	65	70	70	85	95	95	95	100	100	100	100
421192	30	50	60	75	80	90	95	95	95	100	100	100	100
421166	20	35	45	65	65	90	95	95	100	100	100	100	100
421167	10	10	10	25	25	50	85	90	100	100	100	100	100
421159	10	15	15	25	40	50	70	70	90	95	100	100	100

Table 13
(cont.)

Transition of *Spartina alterniflora* foliage into dormancy, 1981

	Dates												
PI No.	10/14	10/20	10/28	11/4	11/10	11/18	11/25	12/1	12/9	12/17	12/23	12/28	1/7/82
421175	15	25	25	45	50	65	90	90	100	100	100	100	100
421185	15	40	65	80	85	95	100	100	100	100	100	100	100
421228	10	15	15	40	40	55	85	90	95	95	100	100	100
T-2804	10	15	20	40	40	60	85	90	100	100	100	100	100
421231	35	45	55	80	85	95	100	100	100	100	100	100	100
421208	20	35	35	40	60	75	90	90	95	100	100	100	100
421199	10	15	15	30	35	50	65	65	90	95	95	95	100
421172	15	20	30	40	50	65	90	95	100	100	100	100	100
421144	10	15	15	20	35	50	60	60	85	90	90	90	95
421169	15	20	30	40	45	60	85	85	100	100	100	100	100
421210	10	15	20	40	45	55	90	90	95	100	100	100	100
T-2808	15	25	30	45	45	60	80	80	85	90	95	95	95
421238	20	30	35	50	50	65	80	80	90	95	95	95	100
421198	10	10	10	20	30	45	45	50	80	80	90	90	95
421221	10	15	15	30	40	55	65	70	90	90	95	95	95

1/Fifteen culms/accession established May 27-June 12 in south pit.

2/Values given are percent dormancy.

Fresh Water Planting
Maryland and Duck, North Carolina

341003F

The banks of fresh water river estuaries and bays are exposed to storms and fluctuating water levels. The resulting erosion removes valuable land and creates the clogging of narrowing channels as well as the formation of new points of land. The loss of valuable land, generally, cannot be replaced and severe clogging of channels is a hazard to water traffic and expensive to remove. The erosion of tidal banks is less severe in fresh water mainly because there are fewer miles of shoreline, reduced exposure and less water fluctuation during the tidal cycle.

Vegetation is an effective and inexpensive method which can be used to help control the erosion of soil caused by wave action. However, at present, no known plant variety exists which can be recommended to successfully help stabilize fresh water tidal banks.

A preliminary assembly consisting of several genera was collected in the fall of 1978 and the spring of 1979. The purpose of this assembly was to screen various species in order to select one or more that have potential for stabilization of fresh water tidal banks.

The first year was utilized to propagate sufficient vegetative material to establish an off-center field evaluation planting. During this period, several accessions failed to perform adequately and were removed from the assembly. In early 1980, a slightly brackish site was selected in North Carolina and 2 replications were planted on it. The tidal cycle on this site was influenced by wind rather than lunar action. The normal daily tidal cycles did not exist and the wind created long periods of dry or flooded conditions. Consequently, this planting is providing very little useable data.

In the spring of 1981, an additional planting was made along the Sassafras River in Kent County, Maryland. Two replications were planted consisting of 18 accessions each. One replication became partially established while the second was lost due to undermining of plants by wave action and the use of poor quality plants. During mid-summer, Rep I was considered a failure and no further evaluations were conducted. Rep II made exceptional growth during the summer months and many accessions appeared to be well established.

This planting was subjected to a storm in December which deposited moderate amounts of sand about mid-way the entire length of the replication. The wind and wave action caused a lodging effect on the Tripsacum dactyloides (eastern gama grass) by forcing its seedheads down upon the soil. The Phragmites australis (giant reed grass) was not affected by the storm and remained upright and erect.

The objective of this project is to select one or more species for additional testing along fresh water tidal streams. Additional plantings are scheduled for establishment during the spring of 1982.

Table 1

Survival and vigor for eighteen accessions on a fresh water tidal area, 1981[1/]

Acc. No.	Species	Initial No. Plants	Survival	Vigor [2/]
T-2792	*Scirpus americanus* R-I	65	3	5
T-2692	*Juncus balticus*	64	1	6
T-2927	*Leersia oryzoides*	50	2	5
K-24	*Tripsacum dactyloides*	53	0	-
T-2789	*S. americanus*	66	0	-
	Spartina alterniflora	68	3	4
T-2825	*Typha angustifolia*	68	9	3
'Shoreline'	*Phragmites australis*	48	1	7
T-2824	*T. angustifolia*	60	0	-
T-2739	*L. oryzoides*	58	0	-
'Kents'	*Phalaris arundinacea*	56	6	5
'Rise'	*P. arundinacea*	64	6	3
PI-421238	*S. patens*	68	4	5
'Garrison'	*Alopecurus arundinaceus*	72	10	4
T-2781	*P. australis*	72	8	6
PI-434199	*P. aquatica*	68	1	7
PI-254903	*P. aquatica*	73	12	4
T-2823	*T. dactyloides*	68	16	3

Table 1
(cont.)

Acc. No.	Species	Initial No. Plants	Survival	Vigor 2/
	R-II			
K-24	*T. dactyloides*	76	14	6
PI-434199	*P. aquatica*	35	0	-
PI-254903	*P. aquatica*	72	40	2
'Kents'	*P. arundinacea*	72	27	3
T-2792	*S. americanus*	92	27	3
T-2781	*P. australis*	84	32	3
T-2692	*J. balticus*	84	12	5
T-2789	*S. americanus*	88	29	3
T-2825	*T. angustifolia*	84	10	4
	S. alterniflora	80	4	6
'Rise'	*P. arundinacea*	76	22	2
T-2927	*L. oryzoides*	80	6	4
PI-421238	*S. patens*	81	25	3
'Garrison'	*A. arundinaceus*	78	9	5
T-2824	*T. angustifolia*	80	0	-
T-2739	*L. oryzoides*	80	0	-
T-2823	*T. dactyloides*	80	6	4
'Shoreline'	*P. australis*	80	0	-

1/Various numbers of plants were established/accession/rep at Chestertown, Maryland on May 14; data recorded June 25.

2/Ratings - 1=Excellent; 3=Good; 5=Fair; 7=Poor; - = No rated.

Table 2

Evaluations for eighteen accessions on a fresh water tidal area, 1981 1/

Acc. No.	Species	Percent Survival 2/	Vigor 3/	Ave. Height (cm) 4/	Plant Survival Below High Water Line 5/	Stabil. Potential 3/
		REP II				
K-24	*Tripsacum dactyloides*	7	7	43	Poor	9
PI-434199	*Phalaris aquatica*	0	-	-	Poor	10
PI-254903	*P. aquatica*	52	4	36	Fair	4
'Kents'	*P. arundinacea*	32	3	48	Fair	4
T-02792	*Scirpus americanus*	29	2	46	Very Good	2
T-02781	*Phragmites australis*	38	1	107	Very Good	1
T-02692	*Juncus balticus*	4	7	23	Good	9
T-02789	*S. americanus*	33	3	46	Very Good	3
T-02825	*Typha angustifolia*	4	3	89	Poor	8
	Spartina alterniflora	0	-	-	Poor	10
'Rise'	*P. arundinacea*	22	2	76	Fair	5
T-02927	*Leersia oryzoides*	8	4	58	Poor	7
PI-421238	*S. patens*	30	3	89	Good	2
'Garrison'	*Alopecurus arundinacea*	6	5	33	Poor	8
T-02824	*T. angustifolia*	0	-	-	Poor	10
T-02739	*L. oryzoides*	0	-	-	Poor	10
T-02823	*Tripsacum dactyloides*	8	4	132	Poor	5
'Shoreline'	*P. australis*	0	-	-	Poor	10

1/Various numbers of plants/accession/rep were established at Chestertown, Maryland on May 14; data recorded on August 20.

2/Survival may be affected by use of poor quality planting stock.

3/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=No survival.

4/Foliage height at the undisturbed position.

5/Ratings: Very Good = 40-60%; Good = 20-40%; Fair = 5-20%; Poor = 0-5%.

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Table 3

Evaluations for eighteen accessions on a fresh water tidal area, 1981[1]

Accession	Species	Percent Soil Cover REP II [2]	Spread [3]	Percent Dormancy [4]	Relative Ability to Trap Sand [5]
K-24	*Tripsacum dactyloides*	5	Poor	85	9
PI-434199	*Phalaris aquatica*	-	-	-	-
PI-254903	*P. aquatica*	75	Fair	5	4
'Kents'	*P. arundinacea*	70	Fair	15	3
T-02792	*Scirpus americanus*	40	Fair	95	6
T-02781	*Phragmites australis*	40	Good	40	5
T-02692	*Juncus balticus*	-	-	-	-
T-02789	*S. americanus*	5	Poor	100	8
T-02825	*Typha angustifolia*	10	Poor	100	8
	Spartina alterniflora	-	-	-	-
'Rise'	*P. arundinacea*	85	Fair-good	40	3
T-02927	*Leersia oryzoides*	90	Fair	100	3
PI-421238	*S. patens*	40	Good	15	3
'Garrison'	*Alopecurus arundinaceus*	15	Poor-fair	5	9
T-02824	*T. angustifolia*	-	-	-	-
T-02739	*Leersia oryzoides*	-	-	-	-
T-02823	*Tripsacum dactyloides*	80	Fair	65	3
'Shoreline'	*Phragmites australis*	-	-	-	-

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[1] Various numbers of plants/accession/rep were established at Chestertown, Maryland on May 14; data recorded on December 2.
[2] Percent of soil covered by vegetative growth.
[3] Ability of plant to spread by means of vegetative growth.
[4] The visual observation of the amount of dormant vegetative growth.
[5] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; - = None. Ratings based on visual observation of sand accumulation.

Table 4

Relative ratings for the four best accessions in a fresh water planting, 1981[1]

	Rep II
Best[2]	'Kents' *Phalaris arundinacea*
2nd best	PI-421238 *Spartina patens*
3rd best	'Rise' *Phalaris arundinacea*
4th best	T-02781 *Phragmites australis*

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[1] Planting was established at Chestertown, Maryland on May 14; data recorded on December 2.

[2] Ratings based on amount of growth, vigor and ability to trap sand.

Woody Plants for Sand Dune Stabilization
34I006C

There are many miles of unstabilized back dunes along the mid-Atlantic coast from North Carolina to Massachusetts. At one time, many of these dunes were vegetated with herbaceous and woody plants which have since disappeared because of changes in the environment, introduced pests and more intense use. Other dunes, which have not been vegetated before with herbaceous or woody plants, could be stabilized with adapted woody species. As a result of natural plant succession, some of these dunes will in time become vegetated with woody species, but this is a slow process. The areas that are partially stabilized with woody plants allow sand movement to occur. While this in itself is not bad, drifting sand from large unstable areas on the back dunes can develop into a serious problem. Woody plants adapted to this environment are not readily available from commercial nurseries for the restoration and protection of coastal dunes.

The objective of this project is to select one or more superior woody cultivar which will be readily adapted to the back dune area in MLRA 149 and 153 of the mid-Atlantic coast.

In 1979, seed collections of four woody species were made from Georgia to Cape Cod, Massachusetts. The four collected species are wax myrtle, *Myrica cerifera*; bayberry, *M. pensylvanica*; *Rosa* spp. and *Prunus* spp.

The seed were planted in the fall of 1979 and emerged in the spring of 1980. A total of 191 accessions were planted. Nearly all accessions exhibited fair to good vigor during the first year of growth within the raised beds.

In the spring of 1981, the rose and *Prunus* spp. were transplanted to an initial observation site at the PMC. The *Myrica* species require two years to develop an adequate root system for satisfactory transplanting. Many of the *Myrica cerifera* accessions were collected south of Maryland. These plants did not tolerate the cold temperatures at Cape May and died during the winter of 1980-81.

Woody Plants for Sand Dune Stabilization, 1981[1]

341006C

Planting Plan

Species	PI No.	Plot No.	Plants (No.)	Date Planted	Source
Prunus maritima	T-13172	101	15	4-16-81	NY
	T-07614	102	15	"	NJ
	T-07632	103	15	"	NJ
	T-07634	104	15	"	MA
	T-09192	105	15	"	DE
	T-09193	106	9	"	MA
	T-09200	107	15	"	DE
	T-09204	108	10	"	DE
	T-11246	109	15	"	MA
	T-11248	110-A	3	"	MA
	T-11249	110-B	3	"	MA
	T-11250	111	11	"	MA
	T-11251	112	13	"	DE
	T-11252	113	15	"	NJ
	T-11275	114	15	"	NJ
	T-12013	115	15	"	DE
P. serotina	T-13173	116	7	"	MA
	T-13174	117	15	"	NJ
	T-15504	118	15	"	NY
	T-13310	119	15	"	NJ
	T-15505	120	15	"	NJ
P. virginiana	T-15506	121	15	"	NY
	T-15507	122	13	"	NY
Rosa rugosa	T-02786	201	15	4-20-81	DE
	T-02787	202	10	"	NJ
	T-07288	203	15	"	DE
	T-07078	204	15	"	
	T-07640	205	15	"	DE
	T-08303	206	15	"	MA
	T-08304	207	15	"	MA
	T-08305	208-A	8	"	MA
	T-08306	208-B	5	"	MA
	T-08307	209	15	"	MA
	T-08308	210	15	4-23-81	MA
	T-08309	211	15	"	MA
	T-08310	212	15	"	MA
	T-08311	213	15	"	MA
	T-09191	214	15	"	DE
	T-11254	215	15	"	NJ
	T-11255	216	15	"	NJ
	T-11256	217	15	"	NJ
	T-11257	218	15	"	NJ
	T-11258	219	15	"	VA
	T-11259	220	15	"	VA
	T-11260	221	15	"	MD
	T-11261	222	15	"	DE

Woody Plants for Sand Dune Stabilization, 1981

341006C

Planting Plan

Species	PI No.	Plot No.	Plants (No.)	Date Planted	Source
R. rugosa	T-11276	301	15	4-27-81	NJ
	T-11277	302	15	"	NJ
	T-11278	303	15	"	NJ
	T-11279	304	15	"	WI
	T-11280	305	15	"	WI
	T-11281	306	15	"	RI
	T-12014	307	15	"	NC
	T-12015	308	15	"	DE
	T-12016	309	15	"	NY
	T-12017	310	15	"	NY
	T-12018	311	15	"	NY
	T-15508	312	15	"	MA
	T-15509	313	15	"	NJ
	T-15510	314	15	"	NJ
	T-15511	315	15	"	DE
Vacant		316 317 318 319			
R. virginiana	T-11282	320	9	"	WI
Rosa sp.	T-15512	321	15	"	NJ

1/Planting is located in Field Nos. 5 & 6 at Cape May PMC.

Table 1

Initial evaluation of woody plants for sand dune stabilization, 1981[1]

Species	PI No.	Height	Width	Vigor	Diameter
		(cm)			(mm)
Prunus maritima	T-13172	45	21	4[2]	7
	T-07614	50	14	3	8
	T-07632	50	19	3	9
	T-07634	45	16	4	8
	T-09192	55	23	3	7
	T-09193	45	23	4	11
	T-09200	50	23	3	6
	T-09204	35	19	3	7
	T-11246	50	36	3	6
	T-11248	30	22	2	9
	T-11249	45	35	4	7
	T-11250	45	27	3	10
	T-11251	45	27	4	14
	T-11252	50	29	3	10
	T-11275	55	22	4	12
	T-12013	40	28	3	12
P. serotina	T-13173	40	18	4	7
	T-13174	45	23	3	10
	T-15504	25	12	5	3
	T-13310	35	12	4	7
	T-15505	35	15	3	5
P. virginiana	T-15506	35	17	6	8
	T-15507	30	14	7	7
Rosa rugosa	T-02786	25	20	5	6
	T-02787	15	20	6	5
	T-02788	30	25	4	5
	T-02778	28	22	5	6
	T-07640	25	17	5	7
	T-08303	25	20	5	6
	T-08304	35	20	4	6
	T-08305	25	20	4	6
	T-08306	25	26	3	5
	T-08307	23	17	4	7
	T-08308	25	8	4	6
	T-08309	30	17	4	7
	T-08310	25	16	4	6
	T-08311	20	17	4	6
	T-09191	30	20	4	8
	T-11254	40	12	5	8
	T-11255	25	16	5	5

Table 1
(cont.)

Initial evaluation of woody plants for sand dune stabilization, 1981

Species	PI No.	Height	Width	Vigor	Diameter
		(cm)			(mm)
Rosa rugosa	T-11256	30	15	4	6
	T-11257	25	17	3	7
	T-11258	25	25	3	8
	T-11259	25	20	4	4
	T-11260	25	19	4	4
	T-11261	25	15	4	7
	T-11276	25	27	3	6
	T-11277	25	9	4	5
	T-11278	25	11	4	3
	T-11279	20	21	4	6
	T-11280	30	17	4	4
	T-11281	30	19	3	4
	T-12014	30	28	3	6
	T-12015	20	15	3	5
	T-12016	25	21	4	7
	T-12017	25	29	4	5
	T-12018	30	17	3	3
	T-15508	25	20	4	5
	T-15509	30	20	4	7
	T-15510	30	20	3	5
	T-15511	30	17	4	6
R. virginiana	T-11282	35	20	3	7
Rosa species	T-15512	25	20	3	7

1/Planting established between April 16 - April 27, 1981; data recorded June 1.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 2

Initial evaluation of woody plants for sand dune stabilization, 1981[1/]

Species	PI No.	Plot No.	Survival (%)	Insect Damage
Prunus maritima	T-13172	101	100	M-SE[2/]
	T-07614	102	100	M
	T-07632	103	100	M
	T-07634	104	100	SL-M
	T-09192	105	100	SL-M
	T-09193	106	100	M
	T-09200	107	100	M
	T-09204	108	100	SL-M
	T-11246	109	100	SL-M
	T-11248	110-A	100	SL
	T-11249	110-B	100	SL-M
	T-11250	111	100	SL-M
	T-11251	112	100	SL-M
	T-11252	113	100	M
	T-11275	114	100	SL-M
	T-12013	115	100	SL-M
P. serotina	T-13173	116	100	SL-M
	T-13174	117	87	M
	T-15504	118	73	SL
	T-13310	119	100	SL
	T-15505	120	100	SL
P. virginiana	T-15506	121	100	SE
	T-15507	122	92	SE
Rosa rugosa	T-02786	201	100	SL
	T-02787	202	90	SL-M
	T-02788	203	100	SL
	T-07078	204	100	SL
	T-07640	205	100	SL
	T-08303	206	100	N
	T-08304	207	100	SL
	T-08305	208-A	100	SL
	T-08306	208-B	100	SL
	T-08307	209	100	N
	T-08308	210	100	SL
	T-08309	211	100	N
	T-08310	212	100	N
	T-08311	213	100	SL
	T-09191	214	100	SL
	T-11254	215	100	M
	T-11255	216	100	SL

Table 2
(cont.)

Initial evaluation of woody plants for sand dune stabilization, 1981

Species	PI No.	Plot No.	Survival (%)	Insect Damage
Rosa rugosa	T-11256	217	100	SL
	T-11257	218	100	SL
	T-11258	219	100	M
	T-11259	220	100	M
	T-11260	221	100	SL
	T-11261	221	100	SL-M
	T-11276	301	100	M
	T-11277	302	100	M
	T-11278	303	100	N
	T-11279	304	100	SL
	T-11280	305	93	SL
	T-11281	306	100	SL
	T-12014	307	93	SL
	T-12015	308	100	SL
	T-12016	309	100	SL
	T-12017	310	100	SL
	T-12018	311	100	SL
	T-15508	312	100	SL-M
	T-12209	313	93	SL
	T-15510	314	100	SL-M
	T-15511	315	100	M M
R. virginiana	T-11282	320	100	M
Rosa sp.	T-15512	321	100	M

1/Planting established between April 16 - April 27, 1981; data recorded July 16.

2/Ratings: N=None; SL=Slight; M=Moderate; SE=Severe.

Table 3

Evaluation of woody plants for sand dune stabilization, 1981[1]

Species	PI No.	Plot No.	Survival (%)	Fruit Prod.[2]	Height (cm)	Width (cm)	Vigor[2]
Prunus maritima	T-13172	101	100	10	110	105	4
	T-07614	102	100	10	130	135	2
	T-07632	103	100	10	109	100	4
	T-07634	104	100	10	90	82	4
	T-09192	105	100	10	117	92	4
	T-09193	106	100	10	120	107	5
	T-09200	107	100	10	125	121	3
	T-09204	108	100	10	130	120	4
	T-11246	109	100	10	113	98	5
	T-11248	110-A	100	10	62	130	5
	T-11249	110-B	100	10	83	105	6
	T-11250	111	100	10	118	118	4
	T-11251	112	100	10	142	125	3
	T-11252	113	100	10	130	118	4
	T-11275	114	100	10	150	140	2
	T-12013	115	100	10	140	140	3
P. serotina	T-13173	116	100	10	100	94	5
	T-13174	117	87	10	135	120	3
	T-15504	118	67	10	70	50	6
	T-13310	119	87	10	106	100	4
	T-15505	120	100	10	136	110	3
P. virginiana	T-15506	121	100	10	101	53	6
	T-15507	122	85	10	125	35	6
Rosa rugosa	T-02786	201	100	3	43	85	4
	T-02787	202	90	7	25	85	6
	T-02788	203	100	2	45	75	4
	T-07078	204	100	4	48	75	5
	T-07640	205	100	4	47	75	5
	T-08303	206	100	5	35	70	6
	T-08304	207	100	5	44	92	5
	T-08305	208-A	100	5	40	85	5
	T-08306	208-B	100	6	43	80	5
	T-08307	209	100	5	36	72	6
	T-08308	210	100	4	40	68	6
	T-08309	211	100	3	46	78	5
	T-08310	212	100	5	42	80	5
	T-08311	213	100	5	35	77	6
	T-09191	214	100	5	47	90	5
	T-11254	215	100	5	46	80	6
	T-11255	216	100	5	38	80	4

Table 3
(cont.)
Evaluation of woody plants for sand dune stabilization, 1981

Species	PI No.	Plot No.	Survival (%)	Fruit Prod.	Height (cm)	Width (cm)	Vigor
Rosa rugosa	T-11256	217	100	4	62	88	3
	T-11257	218	100	3	45	82	5
	T-11258	219	100	3	48	84	4
	T-11259	220	100	4	42	73	5
	T-11260	221	100	5	46	83	4
	T-11261	222	100	3	53	80	4
	T-11276	301	100	3	52	90	2
	T-11277	302	100	2	42	88	3
	T-11278	303	100	3	42	80	3
	T-11279	304	100	3	48	90	4
	T-11280	305	100	3	50	86	5
	T-11281	306	100	3	50	80	4
	T-12014	307	93	4	44	80	5
	T-12015	308	100	4	36	74	5
	T-12016	309	100	4	47	80	4
	T-12017	310	100	6	55	82	3
	T-12018	311	100	3	48	90	3
	T-15508	312	100	4	50	92	3
	T-15509	313	93	5	54	80	5
	T-15510	314	100	6	55	80	5
	T-15511	315	100	2	47	70	4
Vacant		316					
		317					
		318					
		319					
Rosa virginiana	T-11282	320	100	7	88	80	5
Rosa sp.	T-15512	321	100	9	77	90	4

1/Planting established between April 16 - April 27, 1981; data recorded October 22.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Table 4

Percent soil cover and leaf retention for woody plants with sand dune stabilization potential, 1981 1/

Species	PI No.	Plot No.	Soil Cover (%) 2/	Leaf Retention 11-25 (%)	Leaf Retention 12-28 (%)
Prunus maritima	T-13172	101	20	75	5
	T-07614	102	50	85	5
	T-07632	103	25	55	5
	T-07634	104	25	55	0
	T-09192	105	65	90	25
	T-09193	106	10	10	0
	T-09200	107	60	90	35
	T-09204	108	50	80	25
	T-11246	109	10	10	5
	T-11248	110-A	50	75	5
	T-11249	110-B	5	10	10
	T-11250	111	10	5	0
	T-11251	112	40	65	15
	T-11252	113	30	50	0
	T-11275	114	20	35	0
	T-12013	115	20	70	20
P. serotina	T-13173	116	25	70	0
	T-13174	117	45	70	0
	T-15504	118	15	0	0
	T-13310	119	40	60	0
	T-15505	120	40	60	0
P. virginiana	T-15506	121	5	0	0
	T-15507	122	5	0	0
Rosa rugosa	T-02786	201	50	75	5
	T-02787	202	40	70	5
	T-02788	203	50	60	5
	T-07078	204	45	60	5
	T-07640	205	35	55	0
	T-08303	206	30	50	5
	T-08304	207	40	50	5
	T-08305	208-A	45	50	5
	T-08306	208-B	45	50	5
	T-08307	209	35	45	5
	T-08308	210	35	45	5
	T-08309	211	65	60	5
	T-08310	212	55	55	5
	T-08311	213	50	60	20
	T-09191	214	35	40	5
	T-11254	215	45	45	5
	T-11255	216	65	70	10

Table 4
(cont.)

Percent soil cover and leaf retention for woody plants with sand dune stabilization potential, 1981

Species	PI No.	Plot No.	Soil Cover (%)	Leaf Retention (%) 11-25	Leaf Retention (%) 12-28
Rosa rugosa	T-11256	217	65	70	5
	T-11257	218	40	55	5
	T-11258	219	55	60	10
	T-11259	220	55	60	5
	T-11260	221	35	40	5
	T-11261	222	40	50	10
	T-11276	301	65	70	5
	T-11277	302	65	70	15
	T-11278	303	60	55	5
	T-11279	304	60	60	5
	T-11280	305	60	65	10
	T-11281	306	60	65	5
	T-12014	307	60	65	5
	T-12015	308	55	65	10
	T-12016	309	50	60	5
	T-12017	310	50	60	5
	T-12018	311	45	50	5
	T-15508	312	45	50	5
	T-15509	313	45	50	0
	T-15510	314	50	55	5
	T-15511	315	65	70	15
R. virginiana	T-11282	320	65	55	0
Rosa sp.	T-15512	321	50	55	0

1/Planting established between April 16 - April 27, 1981; soil data recorded November 25.

2/Percent of soil covered by vegetative growth on plants.

Juniperus virginiana for Screens and Windbreaks

34I004K

Extensive physical damage to numerous crops occurs annually in New Jersey and other coastal states when high velocity winds blow across the land. People, animals and buildings are also affected. Soil texture, field width and condition of the soil surface are the primary factors associated with this erosion problem. Fine soil particles begin to blow when a wind of 12 to 15 miles per hour is attained 1 foot above the ground surface. Therefore, to prevent or control wind erosion, it is necessary to reduce the wind velocity to a non-erodible rate for the given soil, and/or attain a protective condition on the soil surface. Properly established windbreaks have proven to be successful in helping to overcome this problem.

Several woody species have been used and a few are recommended for windbreaks on inland sites. Many of these are deciduous and some are evergreen such as Juniperus virginiana (Eastern red cedar). This native species is also used by homeowners for screening purposes.

J. virginiana is partially salt tolerant and has been planted and successfully grown on secondary sand dunes. Since this species is adapted to a variety of soil and climatic conditions, it has a large range of adaptation.

This project was started by collecting seed from about 50 locations in several coastal states. The first planting was made in the fall of 1975. The seed of J. virginiana are slow to germinate and the first planting emerged poorly. In 1978, these (2-0) seedlings were lined out and evaluated for growth rate and the desired form. The following year, 122 plants were selected from this planting and replanted in a windbreak design for initial evaluation.

This species is variable in growth rate and form. Some plants in the windbreak have exhibited good growth while others increased very little in height. The growth form varies from columnar to almost oval. The objective of this project is to evaluate the species for a fast growing strain that has dense foliage and columnar form.

Table 1

Height, width and growth rate for *Juniperus virginiana* during the sixth year, 1981 1/

PI No.	Plant No.	Height (cm) 2/			Width (cm) 2/		
		1980	1981	Growth	1980	1981	Growth
T-02738	1	162	210	48	82	95	13
	2	137	190	53	65	95	30
	3	198	240	42	122	145	23
	4	220	260	40	70	90	20
T-02703	1	247	275	28	109	155	46
	2	210	270	60	91	130	39
	3	160	215	55	90	110	20
	4	197	250	53	91	135	44
	5	214	250	36	97	155	58
	6	200	250	50	77	115	38
	7	200	250	50	110	180	70
	8	233	290	57	84	135	51
	9	234	295	61	98	165	67
	10	180	235	55	107	155	48
	11	186	245	59	69	105	36
	12	210	255	45	104	145	41
	13	167	220	53	96	140	44
	14	213	275	62	100	150	50
	15	175	240	65	107	145	38
	16	133	165	32	74	105	31
	17	221	270	49	114	180	66
T-02708	1	213	255	42	108	160	52
	2	193	230	37	103	155	52
	3	162	215	53	70	110	40
	4	222	260	38	110	180	70
	5	196	250	54	86	115	29
	6	177	205	28	90	130	40
	7	192	255	63	83	130	47
	8	173	200	27	81	130	49
	9	194	215	21	82	110	28
	10	216	240	24	97	125	28
	11	200	230	30	100	130	30
	12	219	280	61	120	150	30
	13	218	230	12	106	165	59
	14	204	280	76	94	130	36
	15	167	220	53	90	125	35
	16	207	255	48	102	140	38

Table 1
(cont.)

Height, width and growth rate for
Juniperus virginiana during the sixth year, 1981

PI No.	Plant No.	Height (cm) 1980	Height (cm) 1981	Height (cm) Growth	Width (cm) 1980	Width (cm) 1981	Width (cm) Growth
T-02710	1	195	235	40	96	130	34
	2	193	245	52	110	165	55
	3	196	250	54	87	110	23
	4	184	235	51	73	105	32
	5	229	255	26	95	130	35
	6	214	245	31	93	130	37
	7	204	260	56	96	140	44
	8	176	225	49	113	160	47
	9	169	215	46	122	180	58
	10	206	230	24	103	150	47
	11	173	230	57	108	155	47
	12	182	225	43	96	130	34
	13	184	205	21	110	165	55
	14	198	250	52	72	110	38
	15	210	265	55	103	170	67
	16	200	260	60	105	170	65
T-02711	1	181	120	-61	105	170	65
	2	224	250	26	115	170	55
	3	227	255	28	114	145	31
	4	200	265	65	94	125	31
	5	212	275	63	115	180	65
	6	217	270	53	93	155	62
	7	162	225	63	90	135	45
	8	230	255	25	103	140	37
	9	200	225	25	117	180	63
	10	175	205	30	129	180	51
T-02704	1	197	235	38	89	120	31
	2	183	245	62	90	115	25
	3	208	250	42	93	145	52
	4	182	270	88	98	140	42
	5	211	270	59	120	190	70
	6	207	270	63	82	115	33
	7	209	260	51	92	120	28
	8	194	250	56	85	125	40
	9	200	245	45	86	125	39
	10	179	225	46	96	130	34
	11	176	215	39	82	110	28
T-02705	1	192	235	43	92	140	48
	2	168	195	27	74	125	51
	3	200	245	45	79	125	46
	4	220	285	65	106	135	29
	5	192	270	78	95	130	35
	6	227	280	53	99	160	61
	7	206	280	74	121	185	64

Table 1
(cont.)

Height, width and growth rate for *Juniperus virginiana* during the sixth year, 1981

PI No.	Plant No.	Height (cm) 1980	Height (cm) 1981	Height (cm) Growth	Width (cm) 1980	Width (cm) 1981	Width (cm) Growth
T-02707	1	195	270	75	61	105	44
	2	171	230	59	103	150	47
	3	218	265	47	110	150	40
	4	193	245	52	94	125	31
	5	200	235	35	105	150	45
	6	192	245	53	90	130	40
	7	145	200	55	81	135	54
	8	213	260	47	106	165	59
	9	179	250	71	102	150	48
	10	190	225	35	63	105	42
	11	152	195	43	97	150	53
T-02709	1	210	255	45	103	140	37
	2	216	275	59	125	190	65
	3	213	285	72	130	180	50
	4	215	275	60	88	140	52
	5	191	235	44	110	155	45
	6	217	275	58	103	140	37
	7	220	270	50	89	140	51
	8	210	270	60	68	110	42
	9	216	270	54	93	125	32
	10	200	245	45	112	145	33
	11	189	240	51	112	135	23
	12	210	255	45	120	180	60
	13	220	270	50	117	180	63
T-02738	1	200	255	55	100	130	30
	2	207	260	53	124	170	46
	3	179	230	51	82	120	38
	4	192	250	58	70	105	35
	5	156	190	34	100	120	20
	6	199	240	41	85	100	15
	7	200	245	45	84	105	21
	8	191	225	34	77	105	28
	9	171	235	64	66	95	29
	10	167	220	53	76	105	29
	11	170	230	60	85	120	35
	12	185	240	55	68	95	27
	13	182	235	53	63	90	27
	14	172	215	43	78	100	22
	15	171	230	59	71	105	34
	16	179	240	61	96	145	49
	17	189	245	56	82	100	18

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[1] (2-1) stock was planted in a windbreak design in March 1979.
[2] Growth - Increase in height or width.

Table 2

Evaluations for *Juniperus virginiana*, 1981[1]

PI No.	Plant No.	Vigor[3]	Branch Density[3]	Seed Prod.[4]	Injury[2]
T-02738	1	6	3	10	SL
	2	7	5	7	M
	3	7	6	7	SL
	4	7	6	9	SL
T-02703	1	4	6	10	N
	2	3	5	8	N
	3	7	7	8	SL
	4	6	5	9	N
	5	6	7	3	SL
	6	6	6	9	SL
	7	6	6	5	N
	8	5	5	9	N
	9	5	5	9	N
	10	5	4	10	SL
	11	6	4	10	N
	12	5	4	4	SL
	13	7	7	9	SL
	14	6	6	4	SL
	15	5	4	7	SL
	16	8	6	10	SL
	17	5	6	4	SL
T-02708	1	3	3	9	SL
	2	3	2	10	SL
	3	6	5	10	SL
	4	3	5	2	M
	5[5]	4	4	10	SL
	6	4	3	8	SL
	7	4	4	10	SL
	8	8	7	10	SE
	9	8	8	10	SE
	10[6]	4	4	10	SL
	11	4	4	10	SL
	12	3	3	4	SL
	13	3	5	1	SL
	14	3	4	6	SL
	15	5	4	10	SL
	16	3	3	9	SL

Table 2
(cont.)

Evaluations for *Juniperus virginiana*, 1981

PI No.	Plant No.	Vigor	Branch Density	Seed Prod.	Injury
T-02705	1	4	3	10	SL
	2	6	5	7	SL
	3	3	3	5	SL
	4	2	3	3	SL
	5	2	2	10	SL
	6	2	3	6	SL
	7	3	4	5	SL
T-02707	1	4	3	10	SL
	2	4	3	10	SL
	3	2	3	10	SL
	4	5	5	10	SE
	5	4	5	10	SL
	6	4	4	3	M
	7	4	2	10	SL
	8	4	4	10	SL
	9	6	7	10	SL
	10	8	7	10	SE
	11	5	3	4	SL
T-02709	1	8	7	10	SE
	2	5	5	4	SL
	3	2	3	5	SL
	4	4	3	9	SL
	5	5	4	2	M
	6	5	5	5	SL
	7	7	6	9	SE
	8	7	6	10	SE
	9	4	3	10	SL
	10	3	2	10	SL
	11	4	3	10	SL
	12	3	3	9	SL
	13	3	4	5	SL

Table 2
(cont.)

Evaluations for *Juniperus virginiana*, 1981

PI No.	Plant No.	Vigor	Branch Density	Seed Prod.	Injury
T-02710	1	3	3	10	SL
	2	3	4	10	SL
	3	2	2	5	N
	4	3	2	5	SL
	5	3	3	5	SL
	6	3	3	10	SL
	7	3	4	4	N
	8	4	4	10	SL
	9	4	4	6	SL
	10	3	4	3	SL
	11	3	4	10	SL
	12[5/]	3	4	10	N
	13	5	5	10	N
	14	4	4	5	SL
	15	4	4	10	N
	16	3	3	4	N
T-02711	1	5	4	10	N
	2	5	5	3	M
	3	2	3	10	N
	4	3	4	3	SL
	5[5/]	3	3	9	SL
	6	4	4	10	SL
	7[5/]	4	3	5	SL
	8[6/]	3	4	2	M
	9	5	6	2	M
	10	5	6	2	SL
T-02704	1	5	5	10	SL
	2	5	6	5	SL
	3	5	5	10	SL
	4	5	6	5	SL
	5	5	5	10	SL
	6	5	5	7	M
	7	4	4	4	SL
	8	4	5	5	SL
	9	3	3	5	SL
	10	5	4	10	SL
	11	6	6	3	SL

Table 2
(cont.)

Evaluations for *Juniperus virginiana*, 1981

PI No.	Plant No.	Vigor	Branch Density	Seed Prod.	Injury
T-02738	1	3	2	10	SL
	2	5	5	10	SL
	3	5	4	7	SL
	4	4	2	10	SL
	5	5	2	10	SL
	6	5	2	10	SL
	7	5	3	10	M
	8	6	3	7	M
	9	6	3	10	SL
	10	6	3	10	SL
	11	5	3	10	SL
	12	5	3	10	N
	13	5	4	10	SL
	14	5	4	3	SL
	15	5	3	10	SL
	16	5	2	10	SL
	17	5	3	10	SL
T-02721[7]	1	6	7	10	SL
	2	5	3	10	N
	3	6	6	10	N
T-02696[7]	1	6	5	10	SL
T-02714[7]	1	5	5	10	SL
T-02715[7]	1	4	4	10	SL
T-02716[7]	1	5	7	10	SL
T-02728[7]	1	6	7	10	SL
	2	4	5	10	SL
T-02727[7]	1	4	5	10	SL
T-02734[7]	1	6	5	10	SL

1/Seed was planted in the fall of 1974, emerged in the spring of 1976 and plants were lined out in the spring of 1978. Plants were taken to the present location and transplanted in the spring of 1979; data recorded November 5.

2/Damage caused by insects, disease and winter. Ratings: N=None; SL=Slight; M=Moderate; SE=Severe.

3/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

5/Bag worms on branches.

6/Galls on tree.

7/Plants were transplanted to present location in March of 1981.

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ADVANCED EVALUATIONS

SAND DUNE STABILIZATION

Ammophila arenaria for Sand Dunes

34A007C

Ammophila arenaria (European beachgrass) has been evaluated by the Cape May PMC for several years. While this species is not well adapted to the mid-Atlantic coast foredunes, it may be adapted behind the foredunes where *A. breviligulata* (American beachgrass) deteriorates. Approximately 11 accessions have been evaluated. In 1972, T-02675 was selected for further evaluation. Between 1972 and 1978, seven more accessions were evaluated. Three of these and T-02675 were selected for further testing. During this time, T-02675 was used as the standard. In 1979, PI-319816 became the standard. Because of the variation in the seedling plants of PI-319816, the superior ones were selected and assigned a new number, T-14666. In 1980, two new accessions, T-06650 and T-06651, were moved to advanced evaluation along with T-14666 and T-13176. Further testing will continue with the objective of selecting the best accession for use behind the foredunes.

Evaluation for four accessions of Ammophila arenaria, 1981[1]

Accession	Vigor	Stand	Spreading	Injury (winter)	Stem Density	
T-06651	4[2]	2[2]	3[2]	1[3]	273[4]	153[5]
T-06650	2	1	2	1	421	173
T-14666	3	2	3	-	313	126
T-13176	6	6	3	8	387	58

1/Twenty plants of each accession were transplanted on May 2, 1980.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; data recorded September 28.

3/Ratings: 1=Slight; 5=Moderate; 9=Very Severe; data recorded September 28.

4/Number of stems in the largest hill in the row; data recorded October 14.

5/Number of stems in an average hill in the row; data recorded October 14.

Myrica Species Planting Technique

34C005C

Myrica spp. are native shrubs that are well adapted to sand dune areas along the mid-Atlantic coast. These species are among the dominant woody plants immediately behind the foredune on many natural sites. *M. pensylvanica* (bayberry) occurs chiefly along the U.S. coast from Maine to Maryland. *M. cerifera* (wax myrtle) is adapted from New Jersey southward to Florida. Both species are adapted to sandy conditions but will grow in heavier soils. They are excellent sand stabilizers and are vital to the environment of natural dunes.

While *Myrica* spp. are well adapted to sand dunes along the east coast, the survival rate for bare-root planting stock, using the common method for planting woody species, has been relatively poor. The usual planting stock is two-year-old plants. Two-year-old *M. pensylvanica* seedlings are difficult to plant due to their huge top and root growth. Yet, one-year-old seedlings are generally small and have an inadequate root system. Two-year-old seedlings of *M. cerifera* are somewhat smaller than the same age *M. pensylvanica* plants. When 2-0 stock of *M. cerifera* have been planted on the dune area, the survival rates have varied from very poor to excellent. A technique which would result in consistently high survival rates for bare-root *M. pensylvanica* and *M. cerifera* seedlings on sand dunes is needed.

This project began in the spring of 1980 by planting 1-0 and 2-0 seedlings of the two *Myrica* species on a sand dune in Wildwood Crest, New Jersey. In 1981, another planting was made on a man-made, inland sand dune near Manchester, New Jersey using 1-0 and 2-0 seedlings of both *M. pensylvanica* and *M. cerifera*. The root treatments included: (1) clay slurry applied to roots, (2) organic matter (peat moss) incorporated with soil in the planting hole, (3) super slurper incorporated with soil in the planting hole, (4) peat moss plus super slurper incorporated in the planting hole, and (5) control (no treatment).

Super slurper is a recently developed compound composed of a starchy polymer which can absorb approximately 1,000 times its weight of distilled water. This feature would increase the water holding capacity for coarse textured soils when super slurper is incorporated.

Evaluation results for both plantings indicate that clay slurry is slightly more effective for obtaining good survival than the other treatments used. However, no treatments appeared to be significantly better than the control. The results also show that the 1-0 *M. cerifera* is not suitable for transplanting on sand dunes.

Table 1

Dimensions and growth type at planting time for two woody species, 1981[1]

Treatment Species/ age/Rep	Height (cm)	Width (cm)	Diameter[2] (mm)	Stem Type[3]
Superslurper				
Bayberry (1-0)				
I	14	1	4	S
	9	10	3	M
	8	6	3	M
$\overline{X}$	10.3	5.7	3.3	
II	16	7	2	M
	16	12	5	M
	19	4	3	S
$\overline{X}$	17	7.7	3.3	
III	19	6	5	S
	21	1	4	S
	20	5	3	M
$\overline{X}$	20	4	4	
Bayberry (2-0)				
I	26	5	4	M
	31	16	6	M
	26	10	5	S
$\overline{X}$	27.7	10.3	5	
II	52	17	9	M
	48	14	8	S
	45	14	6	S
$\overline{X}$	48.3	15.0	7.7	
III	42	8	6	S
	38	10	6	S
	41	15	6	S
$\overline{X}$	40.3	11.0	6	

Table 1
(cont.)

Treatment Species/ age/Rep	Height	Width	Diameter	Stem Type
	(cm)		(mm)	
Superslurper				
Wax myrtle (1-0)				
I	26	13	4	S
	22	5	2	M
	13	6	3	S
$\bar{X}$	20.3	8.0	3	
II	24	8	6	S
	22	11	4	S
	14	6	2	M
$\bar{X}$	20	8.3	4	
III	15	1	4	S
	8	1	3	S
	11	5	2	M
$\bar{X}$	11.3	2.3	3	
Wax myrtle (2-0)				
I	42	21	6	S
	45	26	9	S
	45	26	9	S
$\bar{X}$	44.0	24.3	8	
II	20	19	4	M
	21	12	5	S
	42	10	7	S
$\bar{X}$	27.7	13.7	5.3	
III	33	16	4	S
	17	8	4	S
	10	10	5	S
$\bar{X}$	20	11.3	4.3	
Superslurper+Peatmoss				
Bayberry (1-0)				
I	14	7	2	S
	21	1	3	S
	18	2	2	M
$\bar{X}$	17.7	3.3	2.3	
II	19	19	3	M
	21	5	3	M
	23	6	3	M
$\bar{X}$	21	10	3	

Table 1
(cont.)

Treatment/ Species/ age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Stem Type
Superslurper+Peatmoss				
Bayberry (1-0)(cont)				
III	9	10	4	M
	17	6	3	S
	19	1	4	S
$\overline{X}$	15	5.7	3.7	
Bayberry (20)				
I	32	16	5	M
	27	9	6	M
	37	8	5	S
$\overline{X}$	32	11.0	5.3	
II	47	7	8	S
	55	18	9	S
	46	15	6	S
$\overline{X}$	49.3	13.3	7.7	
III	43	13	8	S
	40	5	6	S
	37	11	6	S
$\overline{X}$	40	9.7	6.7	
Wax myrtle (1-0)				
I	6	1	2	S
	16	2	2	S
	12	7	2	M
$\overline{X}$	11.3	3.3	2	
II	25	1	5	S
	23	1	3	S
	20	13	4	M
X	22.7	5.0	4	
III	21	3	4	M
	20	7	4	S
	13	3	3	S
$\overline{X}$	18	4.3	3.7	
Wax myrtle (2-0)				
I	35	16	5	M
	35	27	5	M
	25	10	4	S
$\overline{X}$	31.7	17.7	4.7	
II	30	11	5	S
	34	5	5	S
	36	20	7	S
$\overline{X}$	33.3	12.0	5.7	
III	20	10	7	S
	26	15	5	M
	42	12	7	S
$\overline{X}$	29.3	12.3	6.3	

Table 1
(cont.)

Treatment Species/ age/Rep	Height	Width	Daimeter	Stem Type
	(cm)		(mm)	
Peatmoss				
Bayberry (1-0)				
I	4	1	1	S
	12	6	3	M
	9	4	2	M
X̄	8.3	3.7	2	
II	15	11	4	M
	19	3	3	S
	16	7	3	M
X̄	16.7	7	3.3	
III	20	7	5	M
	20	10	5	M
	23	8	5	M
X̄	21.0	8.3	5	
Bayberry (2-0)				
I	32	6	3	S
	29	5	5	M
	24	2	4	M
X̄	28.3	4.3	4	
II	56	17	6	M
	55	21	8	M
	46	17	6	M
X̄	52.3	18.3	6.7	
III	40[4]	34	8	S
	34	14	7	S
	36	9	5	S
X̄	36.7	19.0	6.7	
Wax myrtle (1-0)				
I	29	10	1	S
	10	11	4	S
	7	7	2	M
X̄	15.3	9.3	2.3	
II	26	1	5	S
	5	1	1	S
	10	6	2	S
X̄	13.7	2.7	2.8	

Table 1
(cont.)

Treatment/ Species/ age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Stem Type
Wax myrtle (1-0)				
III	20	3	4	M
	1	1	5	S
	18	8	3	S
$\bar{X}$	13	4	4	
Wax myrtle (2-0)				
I	38	30	9	S
	34	22	9	S
	34	18	9	M
$\bar{X}$	35.3	23.3	9	
II	23	16	3	S
	20	13	5	M
	32	11	5	S
$\bar{X}$	25	13.3	4.3	
III	20	14	3	M
	30	11	5	S
	36	8	3	S
$\bar{X}$	28.7	11	3.7	
Clay Bayberry (1-0)				
I	10	1	2	S
	20	5	3	M
	8	6	3	M
$\bar{X}$	12.7	4	2.3	
II	32	8	6	S
	30	10	5	M
	26	4	4	M
$\bar{X}$	29.3	7.3	5	
III	17	2	3	S
	10	1	2	S
	5	1	2	S
$\bar{X}$	10.7	1.3	2.3	

Table 1
(cont.)

Treatment Species/ age/Rep	Height	Width	Diameter	Stem Type
	(cm)		(mm)	
Clay				
Bayberry (2-0)				
I	27	13	5	M
	31	12	5	M
	31	6	5	M
X̄	29.7	10.3	5	
II	32	10	6	M
	30	4	7	S
	25	3	5	S
X̄	29.0	5.7	6	
III	54	12	8	M
	40	10	8	M
	46	16	9	M
X̄	46.7	12.7	8.3	
Wax myrtle (1-0)				
I	17	1	4	S
	10	1	2	S
	13	12	2	M
X̄	13.3	4.7	3.3	
II	15	5	4	S
	13	2	3	S
	6	5	2	M
X̄	11.3	4	3	
III	8	1	2	S
	7	1	2	S
	5	3	1	M
X̄	6.2	1.7	1.7	
Wax myrtle (2-0)				
I	40	23	5	S
	42	27	9	S
	43	19	8	M
X̄	41.7	23	7.3	
II	36	12	6	M
	32	7	6	S
	23	10	4	S
X̄	30.3	9.7	5.3	
III	22	9	4	S
	23	12	5	S
	28	12	3	S
X̄	24.3	11	4	

Table 1
(cont.)

Treatment Species/ age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Stem Type
Control				
Bayberry (1-0)				
I	6	1	2	S
	6	6	2	M
	11	11	3	S
X̄	7.7	6	2.3	
II	12	10	2	M
	7	7	3	M
	18	4	2	M
X̄	12.3	7	2.3	
III	10	2	2	S
	9	15	3	M
	23	8	3	M
X̄	14.0	8.3	2.7	
Bayberry (2-0)				
I	32	4	5	S
	36	8	5	S
	30	10	4	S
X̄	32.6	7.3	4.3	
II	41	12	6	S
	43	16	6	S
	41	6	6	S
X̄	41.7	11.3	6	
III	37	14	6	S
	48	21	11	S
	32	14	10	S
X̄	39.0	16.3	9	
Wax myrtle (1-0)				
I	20	11	5	S
	13	3	4	S
	20	1	4	S
X̄	17.7	5	4.3	
II	12	11	3	S
	12	1	2	S
	18	13	3	S
X̄	14.0	8.3	2.7	

Table 1
(cont.)

Treatment Species/ age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Stem Type
Control				
Wax myrtle (1-0)				
III	14	2	2	M
	10	7	2	S
	27	1	5	S
$\bar{X}$	17.0	3.3	3	
Wax myrtle (2-0)				
I	47	23	8	M
	45	34	10	S
	48	24	10	S
$\bar{X}$	46.7	27	9.3	
II	26	8	5	M
	30	12	5	S
	25	15	4	S
$\bar{X}$	27.0	11.7	4.3	
III	27	12	4	M
	20	4	3	S
	14	8	3	M
$\bar{X}$	20.3	8	33	

1/10 seedlings planted March 18; data recorded April 21: Treatments were Superslurper-20gms of SGP - 200 mixed in planting hole; Peatmoss-1 liter of peatmoss mixed in planting hole; Superslupper + Peatmoss both at 20 and 1 mixed in planting hole; Clay - Roots dipped in thick clay slurry; Control - Roots not treated.

2/Diameter measured 5cm above sand line on largest stem of multiple stemmed plants.

3/Ratings - S=Single; M=Multiple.

4/Plant Nos. 2, 5 & 8 were measured for every row except this one where 4, 5 & 8 were measured.

Table 2

Vigor and plant dimensions for two woody species on a coastal sand dune, 1981[1]

Treatment	Height(cm)[2]			Width(cm)[2]			Vigor[3]	Stem[2] Diameter(mm)[4]		
	1	2	3	1	2	3		1	2	3
R-I										
Bayberry(2-0)										
Organic+SS	70	40	66	71	38	74	3	13	11	16
Super Slurper	59	65	79	50	32	85	3	16	9	14
Control	23	56	68	25	24	79	4	5	9	13
Organic	50	42	58	30	65	76	4	9	7	22
Clay	20	52	67	40	49	40	4	3	15	22
Bayberry(1-0)										
Control	38	46	60	58	59	50	6	10	11	13
Organic	33	40	63	34	70	72	5	12	12	13
Clay	60	64	58	60	63	78	5	11	18	20
Organic+SS	64	43	28	57	52	49	4	12	10	15
Super Slurper	42	52	57	76	68	64	4	7	13	25
Wax Myrtle(1-0)										
Clay	25	-	-	20	-	-	9	8	-	-
Super Slurper	57	29	-	52	16	-	7	16	5	-
Organic	33	74	41	27	70	45	5	8	11	15
Organic+SS	-	42	-	-	65	-	8	-	14	-
Control	40	-	-	45	-	-	9	8	-	-
R-II										
Bayberry(1-0)										
Super Slurper	-	-	-	-	-	-	10	-	-	-
Organic	48	-	53	56	-	53	6	18	-	22
Organic+SS	55	47	62	108	52	47	5	23	19	19
Control	36	42	38	24	37	42	5	13	17	13
Clay	53	41	31	60	47	42	5	16	15	16
Bayberry(2-0)										
Control	52	-	42	52	-	24	5	19	-	17
Super Slurper	59	46	48	63	50	55	4	25	22	23
Organic	72	47	38	77	58	39	4	38	18	17
Clay	46	53	55	67	57	74	3	19	20	23
Organic+SS	50	50	48	60	70	46	5	21	20	17
Wax myrtle(1-0)										
Clay	30	36	-	21	35	-	5	17	16	-
Organic+SS	-	-	-	-	-	-	-	-	-	-
Control	-	29	-	-	23	-	6	-	16	-
Super Slurper	-	-	-	-	-	-	-	-	-	-
Organic	28	-	-	24	-	-	6	19	-	-

Table 2
(cont.)

Vigor and plant dimensions for two woody species on a coastal sand dune, 1981

Treatment	Height(cm)			Width(cm)			Vigor	Diameter(mm)		
	1	2	3	1	2	3		1	2	3
R-III										
Bayberry(2-0)										
Organic+SS	18	48	70	18	58	105	3	14	23	23
Organic	55	42	62	68	56	70	4	17	19	23
Control	77	50	60	80	52	85	3	27	19	22
Super Slurper	50	78	72	42	105	75	2	25	19	23
Clay	52	61	52	58	61	40	4	16	21	17
Bayberry(1-0)										
Super Slurper	36	-	20	34	-	19	8	13	-	12
Organic	52	62	31	55	48	47	4	18	16	16
Control	57	24	24	54	23	42	5	14	15	15
Clay	62	53	47	59	69	80	4	19	19	22
Organic+SS	70	58	27	50	58	30	4	19	20	15
Wax myrtle(1-0)										
Clay	25	-	30	20	-	45	6	13	-	17
Organic+SS	47	-	31	24	-	30	5	16	-	14
Control	31	34	39	36	36	35	5	15	16	14
Organic	25	42	35	30	39	23	4	16	17	15
Super Slurper	-	-	34	-	-	27	7	-	-	15

1/Rep I planted April 3, 1980; Rep II and Rep III planted April 7, 1980 at the Wildwood Crest Coast Guard Station; data recorded October 29.

2/Three designated plants were measured within each treatment.

3/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/Diameter was taken at the existing soil level.

Table 3

Survival and vigor for two woody species on an inland sand dune, 1981[1]

Treatment Species/ Age/Rep	Survival (%)	Vigor
Superslurper		
Bayberry (1-0)		
I	80	7
II	100	6
III	70	7
Bayberry (2-0)		
I	100	4
II	70	6
III	70	6
Waxmyrtle (1-0)		
I	60	8
II	80	8
III	20	8
Waxmyrtle (2-0)		
I	80	5
II	100	6
III	50	7
Superslurper + peatmoss		
Bayberry (1-0)		
I	100	6
II	90	6
III	70	7
Bayberry (2-0)		
I	90	6
II	100	4
III	80	5
Waxmyrtle (1-0)		
I	50	9
II	60	9
III	70	8
Waxmyrtle (2-0)		
I	100	6
II	100	5
III	60	6

Table 3
(cont.)

Survival and vigor for two woody species on an inland sand dune, 1981

Treatment Species/ Age/Rep	Survival (%)	Vigor
Peatmoss		
Bayberry (1-0)		
I	80	6
II	100	6
III	100	6
Bayberry (2-0)		
I	100	5
II	90[2]	5
III	100	5
Waxmyrtle (1-0)		
I	30	9
II	60	8
III	50	9
Waxmyrtle (2-0)		
I	100	4
II	90	6
III	80	7
Clay		
Bayberry (1-0)		
I	100	6
II	100	6
III	80	8
Bayberry (2-0)		
I	100	5
II	100	5
III	100	5
Waxmyrtle (1-0)		
I	30	9
II	70	8
III	20	9
Waxmyrtle (2-0)		
I	100	5
II	80	6
III	70	7

Table 3
(cont.)

Survival and vigor for two woody species on an inland sand dune, 1981

Treatment Species/ Age/Rep	Survival (%)	Vigor
Control		
Bayberry (1-0)		
I	90	7
II	100	6
III	100	8
Bayberry (2-0)		
I	100	6
II	100	5
III	80	5
Waxmyrtle (1-0)		
I	60	8
II	80	8
III	20	8
Waxmyrtle (2-0)		
I	100	5
II	70	7
III	60	7

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[1] 10 seedlings planted/treatment March 18; data recorded June 4. Treatments are: Superslurper = 20 grams of SGP-200 mixed in planting hole; Peatmoss = 1 liter of peatmoss mixed in planting hole; Superslupper + peatmoss = at 20 and 1 mixed in planting hole; Clay = Roots dipped in thick clay slurry; Control = Roots not treated.

[2] Only seven seedlings established in this plot.

Table 4

Survival and vigor for two woody species planted on a coastal sand dune, 1981[1]

Treatment Species/ Age/Rep	Survival (%)	Vigor	Treatment Species/ Age/Rep	Survival (%)	Vigor
Superslurper			Peatmoss		
Bayberry (1-0)			Bayberry (1-0)		
I	90	2[2]	I	100	3
II	20	2	II	60	5
III	40	8	III	90	3
Bayberry (2-0)			Bayberry (2-0)		
I	100	3	I	90	4
II	70	4	II	30	3
III	80	3	III	70	3
Wax myrtle(1-0)			Wax myrtle (1-0)		
I	30	6	I	60	3
II	10	3	II	60	4
III	20	8	III	90	5
Superslurper+ Peatmoss			Clay		
Bayberry (1-0)			Bayberry (1-0)		
I	100	5	I	100	4
II	50	4	II	80	3
III	100	3	III	100	2
Bayberry (2-0)			Bayberry (2-0)		
I	100	4	I	100	5
II	80	3	II	100	2
III	80	5	III	100	4
Wax myrtle (1-0)			Wax myrtle (1-0)		
I	30	5	I	10	9
II	0	10	II	50	4
III	30	6	III	70	4

Table 4
(cont.)

Survival and vigor for two woody species planted on a coastal sand dune, 1981

Treatment Species/ Age/Rep	Survival (%)	Vigor
Control		
Bayberry (1-0)		
I	90	4
II	80	3
III	90	4
Bayberry (2-0)		
I	100	4
II	50	4
III	80	4
Wax myrtle (1-0)		
I	10	9
II	40	6
III	70	5

1/Rep I planted April 3, 1980; R-II and R-III planted April 7, 1980 at Wildwood Crest Coast Guard Station; data recorded June 23. Planting included 10 plants/treatment/rep.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

Table 5

Evaluations for two woody species on an inland sand dune, 1981[1]

Treatment Species/ Age/Rep	Height (cm)	Width (cm)	Diameter[2] (mm)	Vigor[3]	Survival[4] (No.)
Superslurper					
Bayberry (1-0)					
I	20	19	5	5	8
	19	25	4		
	11	9	3		
$\bar{X}$	16.7	17.7	4		
II	20	18	4	3	10
	25	30	6		
	31	32	6		
$\bar{X}$	25.3	26.7	5.3		
III	37	37	8	5	7
	37	19	5		
	23	21	6		
$\bar{X}$	32.3	25.7	6.3		
Bayberry (2-0)					
I	38	29	8	3	10
	26	25	8		
	42	33	8		
$\bar{X}$	35.3	29.0	8		
II	-[5]	-	-	3	7
	50	23	9		
	55	45	12		
$\bar{X}$	36.6	22.7	7.0		
III	-	-	-	3	6
	48	41	11		
	-	-	-		
$\bar{X}$	16	13.7	3.7		

Table 5
(cont.)

Evaluations for two woody species on an inland sand dune, 1981

Treatment Species/ Age/Rep	Height (cm)	Width	Diameter (mm)	Vigor	Survival (No.)
Superslurper					
Wax myrtle(1-0)					
I	-	-	-	-	0
	-	-	-		
	-	-	-		
X̄	-	-	-		
II	32	17	7	8	3
	-	-	-		
	-	-	-		
X̄	10.7	5.7	2.3		
III	-	-	-	-	1
	-	-	-		
	-	-	-		
X̄	-	-	-		
Wax myrtle(2-0)					
I	-	-	-	3	7
	55	55	12		
	50	30	10		
X̄	35.0	28.3	7.3		
II	27	30	6	4	8
	-	-	-		
	50	28	10		
X̄	25.7	19.3	5.3		
III	-	-	-	6	4
	20	9	4		
	50	34	8		
X̄	23.3	14.3	4.0		
Superslurper+ Peatmoss					
Bayberry (1-0)					
I	34	36	7	4	8
	29	26	7		
	19	19	5		
X̄	27.3	27.0	5.7		

Table 5
(cont.)

Evaluations for two woody species
on an inland sand dune, 1981

Treatment Species/ Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Survival (No.)
Superslurper+ Peatmoss					
Bayberry(1-0)(cont)					
II	39	29	7	3	9
	38	40	10		
	41	50	8		
X̄	39.3	39.7	8.3		
III	-	-	-	4	6
	9	31	5		
	34	30	6		
X̄	14.3	20.3	3.7		
Bayberry(2-0)					
I	-	-	-	3	9
	46	30	8		
	42	16	8		
X̄	29.3	15.3	5.3		
II	50	18	8	2	10
	65	40	12		
	55	35	8		
X̄	56.7	31.0	9.3		
III	60	50	15	2	8
	70	55	15		
	50	50	13		
	60.0	51.7	14.3		
Wax myrtle(1-0)					
I	-	-	-	7	3
	-	-	-		
	-	-	-		
X̄	-	-	-		
II	34	20	6	8	2
	-	-	-		
	-	-	-		
X̄	11.3	6.7	2.0		
III	34	17	6	6	2
	22	10	4		
	-	-	-		
X̄	18.7	9.0	3.3		

Table 5
(cont.)

Evaluations for two woody species on an inland sand dune, 1981

Treatment Species/ Age/Rep	Height	Width	Diameter	Vigor	Survival
	(cm)		(mm)		(No.)
Superslurper+ Peatmoss(cont.)					
Wax myrtle(2-0)					
I	44	26	10	3	10
	36	55	9		
	22	13	4		
X̄	34.0	31.3	7.7		
II	38	26	8	3	8
	-	-	-		
	60	50	14		
X̄	32.7	25.3	7.3		
III	-	-	-	5	4
	-	-	-		
	60	3	10		
X̄	20.0	1.0	3.3		
Peatmoss					
Bayberry(1-0)					
I	6	13	4	4	8
	40	38	8		
	-	-	-		
X̄	15.3	17.3	4.0		
II	22	26	6	4	10
	20	21	5		
	15	22	4		
X̄	19.0	23.0	5.0		
III	50	50	12	3	8
	25	26	7		
	32	29	9		
X̄	35.7	35.0	9.3		
Bayberry(2-0)					
I	29	43	8	3	9
	45	24	10		
	35	31	10		
X̄	36.3	32.7	9.3		

Table 5
(cont.)

Evaluations for two woody species on an inland sand dune, 1981

Treatment Species/ Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Survival (No.)
Peatmoss					
Bayberry(2-0)(cont)					
II	60	21	9	2	10
	65	38	12		
	55	55	11		
$\bar{X}$	60.0	38.0	10.7		
III	55 6/	45	12	2	7
	50	34	13		
	55	41	13		
$\bar{X}$	53.3	40.0	12.7		
Wax myrtle(1-0)					
I	-	-	-	7	2
	-	-	-		
	-	-	-		
$\bar{X}$	-	-	-		
II	37	30	7	7	2
	-	-	-		
	-	-	-		
$\bar{X}$	12.3	10.0	2.3		
III	-	-	-	5	2
	-	-	-		
	22	14	6		
$\bar{X}$	7.3	4.7	2.0		
Wax myrtle(2-0)					
I	44	41	16	2	10
	39	32	10		
	50	35	12		
$\bar{X}$	44.3	36.0	12.7		
II	21	19	3	4	7
	27	26	6		
	48	35	11		
$\bar{X}$	32.0	26.7	6.7		
III	32	18	6	4	7
	37	15	7		
	40	19	7		
$\bar{X}$	36.3	17.3	6.7		

Table 5
(cont.)

Evaluations for two woody species
on an inland sand dune, 1981

Treatment Species/ Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Survival (No.)
Clay					
Bayberry(1-0)					
I	26	21	6	4	8
	39	36	8		
	21	31	7		
$\bar{X}$	28.7	29.3	7.0		
II	45	40	12	3	9
	40	38	8		
	38	25	9		
$\bar{X}$	41.0	34.3	9.7		
III	-	-	-	4	4
	-	-	-		
	-	-	-		
$\bar{X}$	-	-	-		
Bayberry(2-0)					
I	35	28	8	3	10
	42	23	8		
	44	33	8		
$\bar{X}$	40.3	28.0	8.0		
II	45	30	11	3	8
	45	23	8		
	35	20	7		
$\bar{X}$	41.7	24.3	8.7		
III	70	44	12	2	10
	50	60	9		
	70	60	14		
$\bar{X}$	63.3	54.7	11.7		
Wax myrtle(1-0)					
I	-	-	-	7	1
	-	-	-		
	-	-	-		
$\bar{X}$	-	-	-		

Table 5
(cont.)

Evaluations for two woody species
on an inland sand dune, 1981

Treatment Species/ Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Survival (No.)
Clay(cont.)					
Wax myrtle(1-0)					
II	-	-	-	7	4
	16	7	3		
	-	-	-		
$\bar{X}$	5.3	2.3	1.0		
III	-	-	-	-	0
	-	-	-		
	-	-	-		
$\bar{X}$	-	-	-		
Wax myrtle(2-0)					
I	44	34	7	2	10
	50	45	12		
	60	42	14		
$\bar{X}$	51.3	40.3	11.0		
II	-	-	-	5	7
	41	21	11		
	31	25	6		
$\bar{X}$	24.0	15.3	5.7		
III	-	-	-	7	3
	33	23	77		
	-	-	-		
$\bar{X}$	11.0	7.7	2.3		
Control					
Bayberry(1-0)					
I	21	10	4	5	8
	15	26	4		
	30	29	5		
$\bar{X}$	22.0	21.7	4.3		
II	-	-	-	4	4
	-	-	-		
	-	-	-		
$\bar{X}$	-	-	-		

Table 5
(cont.)

Evaluations for two woody species on an inland sand dune, 1981

Treatment Species/ Age/Rep	Height	Width	Diameter	Vigor	Survival
	(cm)		(mm)		(No.)
Control (cont.)					
Bayberry(1-0)					
III	-	-	-	4	6
	22	36	6		
	30	33	7		
$\bar{X}$	17.3	23.0	4.3		
Bayberry (2-0)					
I	36	30	10	4	10
	38	27	5		
	33	9	3		
$\bar{X}$	35.7	22.0	6.0		
II	47	30	8	2	10
	46	25	9		
	60	47	12		
$\bar{X}$	37.7	34.0	9.7		
III	-	-	-	2	8
	70	40	15		
	50	42	14		
$\bar{X}$	40.0	27.3	9.7		
Wax myrtle(1-0)					
I	24	20	5	6	4
	-	-	-		
	-	-	-		
$\bar{X}$	8.0	6.7	1.7		
II	18	20	4	8	2
	-	-	-		
	-	-	-		
$\bar{X}$	6.0	6.7	1.3		
III	-	-	-	-	1
	-	-	-		
	-	-	-		
$\bar{X}$	-	-	-		

Table 5
(cont.)

Evaluations for two woody species on an inland sand dune, 1981

Treatment Species/ Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Survival (No.)
Control(cont.)					
Wax myrtle(2-0)					
I	60	26	10	2	10
	50	65	13		
	60	43	13		
$\overline{X}$	56.7	44.7	12.0		
II	-	-	-	5	6
	33	25	6		
	31	26	7		
$\overline{X}$	21.3	17.0	4.3		
III	33	15	6	6	3
	-	-	-		
	-	-	-		
$\overline{X}$	11.0	5.0	2.0		

1/10 seedlings planted March 18; data recorded October 22. Treatments were Superslurper-20 gms of SGP - 200 mixed in planting hole; Peatmoss-1 liter of peatmoss mixed in planting hole; Superslupper+ Peatmoss both at 20 and 1 mixed in planting hole; Clay-Roots dipped in thick clay slurry; Control-Roots not treated.

2/Diameter measured 5 cm above sand line on largest stem of multiple stemmed plants.

3/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/Ten planted - Number surviving.

5/- = Designated plants for measurement missing.

6/Plant Nos. 2, 5 and 8 were measured for every row except this one where 5 and 8 were measured.

Pest-resistant Plants for Secondary Dune Stabilization

34A012C

Ammophila breviligulata (American beachgrass) is well adapted to the foredunes and beach areas in front of the foredunes. A superior cultivar of *A. breviligulata* 'Cape' was introduced in 1972 and since that time has been used extensively for dune stabilization from Massachusetts to Virginia. However, plantings of Cape and native strains of *A. breviligulata* behind the foredune and sometimes on the foredune tend to deteriorate after accumulation of sand ceases or in the absence of fertilizer applications.

Large vegetated areas behind the foredune along the Atlantic Coast are subjected to disease and/or insect damage. Prior to infestation, these sites are usually planted to or volunteer into *A. breviligulata*. After a period of time, the plants exhibit poor vigor and the stand is reduced considerably resulting in little or no cover. While the deterioration of the beachgrass is a natural phenomenon, the invasion of long-lived perennial grasses into the weakened stands of beachgrass is a slow process. Proper management does not necessarily prevent stand deterioration. No recommended adapted, disease resistant grass is commercially available for planting on these sites.

The objective is to test several long-lived salt tolerant species for persistence behind the foredune where *A. breviligulata* stands have deteriorated due to disease or other problems. Since long-lived species generally develop slowly, as compared to *A. breviligulata*, considerable time will be required to evaluate the benefit of the long-lived species.

The first planting was installed at Island Beach State Park, New Jersey in 1978. None of the species produced the amount of foliage that is usually observed for that species when planted on a recently formed sand dune. Even Cape failed to respond with vigorous growth on this apparently diseased site. While *Elymus arenarius* (European wildrye) was the best test species on this diseased site in 1978, the amount of foliage and vigor was not outstanding. During the year of establishment, Cape performed better than all of the other species. Since Cape is not well adapted to these back dune areas, this really is not significant.

In 1979, 1980 and 1981, expanded plantings were established in Delaware. During 1980, the data from the 1979 planting indicated that Cape was the best species but *Panicum amarum* (bitter panicgrass) looked good. A visual observation of the 1979 and 1981 plantings still favors *P. amarum* second to Cape.

Spartina patens (saltmeadow cordgrass) and *Carex arenaria* (European sedge) were added to the plan in 1980 and 81 in Delaware and in North Carolina in 1980. In the North Carolina planting established in 1980, Cape was definitely superior during the first year. Cape had begun to lose its superiority by September 1981. While Cape is still the best species, *C. kobomugi* (Japanese sedge) and *S. patens* PI-421239 rated more equally with Cape than during the first year.

In 1981, a separate but related planting project began under a joint US-Israel agreement. The plots were established in Delaware and Virginia with five accessions interplanted with Cape. Considerable data has been recorded but first year results are not conclusive.

Table 1

Third year vigor and damage for pest-resistant plants growing on a sand dune, 1981[1]

Species/ Rep	May 14			August 18		
	Vigor[2]	Insect Damage[3]	Disease Damage[3]	Vigor[2]	Insect Damage[3]	Disease Damage[3]
Ammophila arenaria						
I	5	3	3	7	3	6
II	6	3	3	6	3	6
III	5	3	3	7	3	6
Elymus arenarius						
I	8	3	3	9	8	8
II	7	3	3	8	6	7
III	8	3	3	8	6	7
E. vancouverensis						
I	8	3	3	7	6	6
II	8	3	3	7	5	6
III	8	3	3	7	5	6
Panicum amarum						
I	6	2	2	7	5	6
II	5	2	3	7	5	6
III	6	2	2	7	5	6
A. breviligulata						
I	4	2	3	6	4	5
II	4	2	3	5	3	4
III	4	2	3	6	4	4

---

[1] 50 vegetative plants established/accession/replication at Fenwick Island State Park, Delaware on April 3, 1979.

[2] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

[3] Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Table 2

Third year evaluations for pest-resistant plants growing on a sand dune, 1981[1]

Species/ Rep	Stem Count[2]	Foliage Spread (cm)	Height (cm)	Vigor	Insect Damage	Disease Damage
Ammophila arenaria						
I	40	32	60	6[3]	7[4]	7[4]
II	40	30	60	5	7	7
III	40	32	60	5	7	7
Elymus arenarius						
I	5	8	12	9	7	7
II	8	12	15	8	7	7
III	5	10	12	9	7	7
E. vancouverensis						
I	8	12	14	8	7	7
II	10	15	16	7	7	7
III	8	14	14	8	7	7
Panicum amarum						
I	20	30	18	5	4	4
II	30	35	20	4	4	4
III	25	30	18	5	4	4
A. breviligulata						
I	45	50	65	4	5	5
II	50	60	68	3	5	5
III	45	55	65	4	5	5

---

[1] 50 vegetative plants established/accession/replication at Fenwick Island State Park, Delaware on April 3, 1979; data recorded Nov. 5.

[2] Number of plants growing in a 0.25 M^2 area.

[3] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

[4] Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Table 3

Characteristics for nine pest-resistant species growing on a sand dune, 1981[1]

Species/ Rep	Stand	Vigor	Regrowth[2]	Cover[3] (%)
T-02675 *Ammophila arenaria*				
I	9[4]	-	-	-
II	10	-	-	-
III	10	-	-	-
'Cape' *A. breviligulata*				
I	1	2[4]	2[4]	60
II	2	4	3	50
III	2	2	1	55
T-02688 *Carex arenaria*				
I	9	-	-	-
II	9	-	-	-
III	10	-	-	-
PI-433953 *C. kobomugi*				
I	5	3	4	15
II	2	2	3	35
III	7	4	5	10
PI-348865 *Elymus arenarius*				
I	3	2	3	20
II	2	3	4	25
III	3	4	5	15
PI-421134 *E. vancouverensis*				
I	3	3	3	15
II	2	2	3	35
PI-421238 *Spartina patens*				
I	4	5	5	20
II	3	5	5	40
III	7	7	7	10
III-6	4	3	2	30

Table 3
(cont)

Species/ Rep	Stand	Vigor	Regrowth	Cover (%)
PI-421239 S. patens				
I	2	3	4	25
II	3	5	6	25
III	2	2	1	40
PI-421250 S. patens				
I	3	4	6	15
II	4	6	7	20
III	5	5	6	10

1/114 hills/accession/replication planted near Duck, NC on April 2, 1980; data recorded April 28.

2/Regrowth - Amount of new foliage.

3/Cover - Includes dead and green foliage of rated species that provides sand cover.

4/Ratings - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Table 4

Characteristics for nine pest-resistant species growing on a sand dune, 1981[1]

Species/ Rep	Stand	Vigor	Disease Injury	Cover[2] (%)
T-02675 Ammophila arenaria	[3]			
I	9	-	-	-
II	10	-	-	-
III	10	-	-	-
'Cape' A. breviligulata				
I	2	2	2	2
II	5	4	2	5
III	2	1	2	2
T-02688 Carex arenaria				
I	8	7	2	9
II	9	-	-	-
III	10	-	-	-
PI-433953 C. kobomugi				
I	4	3	2	4
II	4	3	2	4
III	6	4	4	6
PI-348865 Elymus arenarius				
I	8	6	3	8
II	6	4	4	7
III	9	-	-	-
PI-421134 E. vancouverensis				
I	6	5	6	7
II	6	5	4	7
PI-421238 Spartina patens				
I	3	2	1	4
II	2	2	2	4
III	4	4	2	4
III-9	4	3	2	6

Table 4
(cont.)

Characteristics for nine pest-resistant species growing on a sand dune, 1981[1]

Species/ Rep	Stand	Vigor	Disease Injury	Cover (%)
PI-421239 *S. patens*				
I	2	1	1	3
II	3	3	1	4
III	2	1	3	2
PI-421250 *S. patens*				
I	3	3	2	4
II	6	5	1	7
III	3	2	3	4

1/114 hills/accession/replication planted near Duck, NC on April 2, 1980; data recorded September 16.

2/Cover - Includes dead and green foliage of rated species that provides sand cover.

3/Ratings - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None; - = No rating.

Table 5

Relative rating of nine pest-resistant species for sand dunes, 1981[1]

	R-I	R-II	R-III
Best[2]	'Cape'	Cape	Cape
2nd best	*Elymus arenarius*	*E. vancouverensis*	*S. patens* (PI-421239)
3rd best	*Spartina patens* (PI-421239)	*E. arenarius*	*S. patens* (PI-421238)

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[1] Planting established with vegetative material at Duck, NC on April 2, 1980; data recorded April 28.

[2] Ratings on stand, amount of foliage and ability to still blowing sand.

Table 6

Relative rating of nine pest-resistant species for sand dunes, 1981[1]

	R-I	R-II	R-III
Best[2]	'Cape'	*Carex kobomugi*	Cape
2nd best	*Spartina patens* (PI-421239)	Cape	*S. patens* (PI-421239)
3rd best	*C. kobomugi*	*S. patens* (PI-421238)	*S. patens* (PI-421238)

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[1] Planting established with vegetative material at Duck, NC on April 2, 1980; data recorded September 16.

[2] Ratings on stand, amount of foliage and ability to still blowing sand.

Table 7

Second year vigor and damage for pest-resistant plants growing on a sand dune, 1981[1]

Species/ Rep	May 14			August 18		
	Vigor	Insect Damage	Disease Damage	Vigor	Insect Damage	Disease Damage
Ammophila arenaria						
I	5[2]	2[3]	2[3]	6[2]	3[3]	4[3]
II	6	2	2	7	3	5
III	5	2	2	7	3	4
Elymus arenarius						
I	9	2	3	8	4	6
II	9	2	3	8	4	6
III	7	2	2	7	4	6
E. vancouverensis						
I	8	2	2	7	5	5
II	7	2	2	8	4	5
III	7	2	2	8	4	5
Panicum amarum						
I	8	2	2	7	3	5
II	8	2	2	6	3	5
III	8	2	2	7	3	5
Carex kobomugi						
I	7	2	2	6	2	3
II	8	2	2	7	2	3
III	6	2	2	6	2	3
A. breviligulata						
I	3	2	2	4	2	3
II	4	2	2	5	3	4
III	3	2	2	5	3	4

Table 7
(cont.)

Second year vigor and damage for pest-resistant plants growing on a sand dune, 1981

Species/ Rep	May 14			August 18		
	Vigor	Insect Damage	Disease Damage	Vigor	Insect Damage	Disease Damage
Spartina patens (421250)						
I	7	2	2	7	3	5
II	7	2	2	7	3	5
III	7	2	2	6	2	4
S. patens (421239)						
I	6	2	2	7	3	6
II	7	2	2	8	3	6
III	7	2	2	8	3	5
S. patens (421238)						
I	6	2	2	7	3	4
II	6	2	2	7	3	5
III	7	2	2	7	3	4

1/108 vegetative plants established/accession/replication at Fenwick Island State Park, Delaware on March 25, 1980; some accessions in R-III had less than 108 plants.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Table 8

Second year evaluations for pest-resistant plants growing on a sand dune, 1981[1]

Species/ Rep	Stem Count[2]	Foliage Spread (cm)	Height (cm)	Vigor	Insect Damage	Disease Damage
Ammophila arenaria						
I	20	15	40	7[3]	6[4]	6[4]
II	15	15	38	7	6	6
III	20	18	40	6	6	6
Elymus arenarius						
I	3	8	7	9	6	6
II	5	10	10	8	6	6
III	5	10	10	8	6	6
E. vancouverensis						
I	3	6	20	8	6	6
II	3	5	20	8	6	6
III	4	6	22	7	6	6
Panicum amarum						
I	3	10	25	7	4	4
II	8	20	25	5	4	4
III	8	12	22	7	4	4
Carex kobomugi						
I	7	25	12	5	2	2
II	4	10	10	6	3	4
III	15	40	18	4	3	3
A. breviligulata						
I	40	25	60	3	4	4
II	35	25	60	4	4	4
III	40	28	65	3	4	4

Table 8
(cont.)

Second year evaluations for pest-resistant plants growing on a sand dune, 1981

Species/ Rep		Stem Count	Foliage Spread (cm)	Height (cm)	Vigor	Insect Damage	Disease Damage
Spartina patens	(421250)						
I		10	13	35	6	5	5
II		15	15	30	6	5	5
III		20	18	40	5	4	4
S. patens	(421239)						
I		18	16	40	4	4	4
II		16	14	35	5	4	4
III		16	14	32	6	4	4
S. patens	(421238)						
I		28	20	50	4	4	4
II		25	20	45	5	4	4
III		30	20	45	5	4	4

1/108 vegetative plants established/accession/replication at Fenwick Island State Park, Delaware on March 25, 1980; some accessions in R-III had less than 108 plants; data recorded November 5.

2/Number of stems growing in a 0.25 M^2 area.

3/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Table 9

Evaluations for pest-resistant plants growing on a sand dune, 1981[1]

Species/ Rep	May 14		August 18			
	Survival (No.)	Vigor	Survival (No.)	Vigor	Insect Damage	Disease Damage
Ammophila arenaria						
I	108	5[2]	100	5[2]	2[3]	2[3]
II	107	5	105	5	2	2
III	108	5	106	5	2	2
Elymus arenarius						
I	106	4	34	6	2	2
II	108	4	99	6	2	2
III	108	4	96	6	2	2
E. vancouverensis						
I	38	7	40	8	2	3
II	55	7	52	8	2	2
III	68	7	65	6	2	3
Panicum amarum						
I	48	8	98	5	2	2
II	39	7	100	5	2	2
III	27	8	96	5	2	2
Carex kobomugi						
I	36	8	64	6	1	1
II	8	9	69	6	1	1
III	27	8	79	6	2	2
A. breviligulata						
I	108	4	102	3	2	2
II	108	4	108	3	2	2
III	108	4	108	3	2	2

Table 9
(cont.)

Evaluations for pest-resistant plants growing on a sand dune, 1981

Species/ Rep		May 14		August 18			
		Survival (No.)	Vigor	Survival (No.)	Vigor	Insect Damage	Disease Damage
Spartina patens	(421250)	4/	4/				
I		-	-	86	7	2	2
II		-	-	95	7	2	2
III		-	-	100	7	2	2
S. patens	(421239)						
I		-	-	38	8	2	3
II		-	-	86	6	2	2
III		-	-	60	8	2	3
S. patens	(421238)						
I		-	-	41	8	2	2
II		-	-	92	8	2	2
III		-	-	91	7	2	2

1/108 vegetative plants established/accession/replication at Fenwick Island State Park, Delaware on March 31, 1981.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

4/- = Not evaluated at this time.

Table 10

Evaluations for pest-resistant plants seven months after planting on a sand dune, 1981[1]

Species/ Rep	Survival (No.)	Stem Count[2]	Foliage Spread (cm)	Height (cm)	Vigor	Insect Damage	Disease Damage
Ammophila arenaria							
I	97	30	10	40	4[3]	3[4]	3[4]
II	105	27	10	45	4	3	3
III	104	28	10	42	4	3	3
Elymus arenarius							
I	30	4	7	20	8	3	3
II	90	6	10	24	6	3	3
III	90	5	8	23	7	3	3
E. vancouverensis							
I	32	4	6	18	8	4	4
II	38	4	5	16	8	4	4
III	62	5	7	20	6	4	4
Panicum amarum							
I	95	5	20	22	6	2	2
II	100	5	20	25	4	2	2
III	96	6	26	28	4	2	2
Carex kobomugi							
I	70	5	20	12	4	2	2
II	55	5	16	10	5	2	2
III	78	5	18	10	5	2	2
A. breviligulata							
I	102	30	14	48	3	3	3
II	105	26	18	50	3	3	3
III	108	28	15	50	3	3	3

Table 10
(cont.)
Evaluations for pest-resistant plants seven months after planting on a sand dune, 1981

Species/ Rep	Survival (No.)	Stem Count	Foliage Spread (cm)	Height (cm)	Vigor	Insect Damage	Disease Damage
Spartina patens (421250)							
I	80	10	8	28	6	4	4
II	94	7	7	26	6	4	4
III	100	9	9	28	5	4	4
Spartina patens (421239)							
I	30	9	5	20	7	4	4
II	85	9	6	30	6	4	4
III	60	7	5	25	6	4	4
S. patens (421238)							
I	40	10	7	20	6	4	4
II	85	10	7	18	7	4	4
III	90	12	7	20	6	4	4

1/108 vegetative plants established/accession/replication at Fenwick Island State Park, Delaware on March 31, 1981; data recorded November 5.

2/Number of stems growing in a 0.25 M^2 area.

3/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Revegetation of Sand Dunes

Binational Agriculture Research and Development (BARD)

34C024C

Ammophila breviligulata (American beachgrass) has been successful in most cases for temporary stabilization of sand dunes. However, the cover it provides alone is not adequate to prevent strong winds from blowing and depositing sand onto agriculture or other type lands. While *A. breviligulata* is considered effective as an erosion control plant, it is often short-lived due to natural deterioration.

Plants which are persistent on extremely sandy soils and can be interplanted with *A. breviligulata* are needed to provide quality vegetation which will prevent the blowing of sand onto prime lands. Proven fertilization methods are also necessary to increase the vigor of existing woody plants on sand dune areas.

The BARD project is a cooperative effort between Israel and the United States. The project encompasses studies in Israel, Delaware, Virginia and California. The New Jersey portion of the project began in March 1981 near Fenwick, Delaware and Virginia Beach, Virginia. Two types of plantings were evaluated at each location during the establishment year. One study involved "Interplanting of long-lived herbaceous species with *A. breviligulata* 'Cape'." These plantings were established on unstable sand dunes that had previously been vegetated with *A. breviligulata* but were barren at planting time. The other situation was located on unstable dunes that were partially covered with native perennial vegetation which was in a poor state of vigor. This study involved "An evaluation of the effect of fertilizer treatments on the invasion of long-lived perennial ground cover species and improved vigor of plant growth on mid-Atlantic sand dunes".

The five herbaceous species which were interplanted with *A. breviligulata* are *Carex kobomugi* (Japanese sedge), *C. arenaria* (European sedge), *Elymus arenarius* (European wildrye), *E. vancouverensis* (Vancouver wildrye) and *Panicum amarum* (bitter panicgrass).

Survival during the 30 day period following transplanting was almost perfect for *E. arenarius*. However, by late fall, the mortality for this species exceeded 90% for the Virginia location while it was about 30% for the Delaware location. *C. kobomugi* and *P. amarum* exhibited the best fall survival at the Virginia location while *P. amarum*, *C. kobomugi* and *E. arenarius* exhibited fall survival near the 75% level at the Delaware location. Since the *Elymus* spp. are cool season grasses, it was not unexpected that these two species rated best for early season vigor. *P. amarum* had the best vigor on the fall evaluation date. The species with the best culm density during September was *P. amarum* followed by *E. arenarius*. Based on visual observation *P. amarum* was clearly the best species in September for the Virginia location while *C. kobomugi* and *P. amarum* were the best species at the Delaware location. Detailed data were not recorded for *A. breviligulata* 'Cape' but essentially 100% of the plants survived. It was superior to all interplanted species at both locations. In other plantings involving Cape and other sand dune grasses, Cape has appeared more vigorous and produced better first year cover than any other species.

Effect of Fertilizer on the Invasion of Long-Lived Perennials

Prunus serotina (black cherry) and *Myrica* spp. were the dominant woody species for the Virginia location while *Myrica* spp. were clearly dominant at the Delaware location. There was no significant change or even a trend in the dominant species during the year. Total canopy and canopy afforded by each species did not significantly change during the year. The amount of variation for canopy from spring to fall evaluation was greater within a fertilizer treatment than among treatments. While vigor was not clearly improved by fertilizer, the trend at the Virginia location was toward increased vigor with increases in fertility.

Binational Agricultural Research and Development (BARD) Project Plan[1/]

1. TITLE OF RESEARCH:

ACCELERATING THE DEVELOPMENT OF STABILIZING PLANT COVER ON SAND DUNES

PROJECT NO: 34C024C

2. DESCRIPTION OF THE PROBLEM:

A. Sand Dunes on the Globe. Vast areas of sand dunes cover the globe. These areas, when not covered by proper vegetation, move into fertile land, decreasing the world's agricultural production. Thus, both "coastal dunes" as well as "continental dunes" may cause severe damage to agriculture. Until now, more efforts have been made to cope with the coastal dunes problem. Nevertheless, both of them are still lacking efficient methods of control.

B. In the U.S.A. Despite the fact that certain successes have been achieved along the mid-Atlantic coast from North Carolina to Massachusetts (as well as along other coasts) in stabilizing the frontal dunes by vegetative cover - primarily by American beachgrass (*Ammophila breviligulata*) - this cover is not adequate to prevent the blowing of the sand into agricultural crops over the long run. *A. breviligulata* is an excellent plant for temporary stabilization, but is short-lived, obviously due to natural deterioration.

On the other hand, the invasion of long-lived grasses, forbs, vines and shrubs is very slow. Severe erosion can occur during the interval between the destruction or deterioration of the existing cover and the natural invasion of long-lived stabilizing vegetation.

3. OBJECTIVES:

A. To develop an anti-erosional plant cover, as a succession of *Ammophila* species, for long-term protection of agricultural crops.

B. To improve sand dune areas with the help of this plant cover and of fertilizing methods, for real agricultural production.

C. To investigate some plant species of this cover to determine their economic productivity.

[1/] The BARD project is a cooperative effort between Israel and the United States. The project encompasses studies in Israel, Delaware, Virginia and California. As a result, the project plan is a rather lengthy document. The Cape May PMC is responsible for the Delaware-Virginia portion of the project. In the interest of brevity, the project plan has been abridged to reflect only those aspects which concern the Cape May PMC.

4. DESCRIPTION OF THE RESEARCH PLAN:

The research plan is based upon field experiments in New Jersey, California and Israel. At the two latter places, the same plant species will be investigated. Additional species will be tested out of New Jersey. The size of all the experimental plots will be approximately identical. The evaluation methods will be identical for all of them.

The study will be conducted on each of two different types of dune conditions:

I. Dunes that were once vegetated with *A. breviligulata* (in the United States), or *A. arenaria* (European beachgrass) (in Israel), but are now unstable again due to the deterioration of the grass, induced by storms or man. The study will be based upon "Interplanting of long-lived herbaceous species with Cape *A. breviligulata*". The study will consist of the following details:

A. Location: Delaware, Virginia

B. Species to be planted:
  1. *Elymus arenarius*
  2. *E. vancouverensis*
  3. *Carex kobomugi*
  4. *Panicum amarum*

C. There will be three replications of each species at each location.

D. Plant spacing within each plot will be 0.45 meters within and between rows.

E. Row sequence: Each plot will contain two rows of *A. breviligulata* alternated with one row of the interplanted species.

F. Plot size: There will be four rows of the interplanted species, with 20 hills per row in each plot.

G. Planting dates: March 15 to April 1, 1981 (Delaware and Virginia)

H. Management of established plantings: First year fertilization will be at the rate of 500 kg/ha of 10-10-10 fertilizer at transplanting time and 500 kg/ha of 10-10-10 in June. The second and third years, the plots will be split and one-half of each plot will be fertilized with 750 kg/ha in April. The site will be maintained free of woody or other perennial herbaceous species.

I. Evaluations:

The following evaluations will be recorded the first year:

(1) Percent survival of each species will be determined in May and October.

(2) The amount of growth will be determined in September by counting the number of stems of a species within one meter of row for each plot and a comparative rating 1-10 used for each species with 1 being best.

(3) Vigor will be determined for each species within a plot by using a rating of 1-10 with 1 best.

(4) The following meteorological measurements on days of extreme values will be carried out near and inside the experimental plots:
   (a) Air and soil temperatures
   (b) Relative humidity of the air
   (c) Soil humidity in a depth of 10, 20 and 60 cm
   (d) Wind velocities before and behind the experimental plots.

The following evaluation will be made the second and third year:

(1) Survival as described above.

(2) Effective cover will be recorded in May and October by using a percent ground cover rating for each species within a plot and for the performance of the combination of the two species within the plot. In both cases, there will be an indication of the percent of cover being provided by the beachgrass or by the interplanted species.

(3) Spreading ability will be determined by counting the number of culms of the interplanted species in a plot within a 1 m square area in August of each year.

(4) Seed production - an evaluation of the seed produced by each species will be made at the end of the growing season by counting the number of seedheads per row of a species and examining the seedheads for viable seed.

(5) A vigor rating will be made in May and September for each species within a plot on the basis of 1-10; with 1 being best.

II. The second dune situation is dunes partially stabilized with plants behind coastal and in continental dunes, that are in a poor state of vigor and where the site is unstable due to lack of perennial ground cover. The study to be conducted on this site is as follows:

> "An Evaluation of the Effects of Fertilizer Treatments on the Invasion of Long-Lived Perennials Ground Cover Species and Improved Vigor of Plant Growth on mid-Atlantic Sand Dunes".

The treatments will consist of the following:

A. Location: Delaware and Virginia

B. Fertilizer treatments:
   1. Broadcast 750 kg/ha of 10-5-5 about April 1 and 750 kg/ha of 10-5-5 about June 1.
   2. Broadcast 375 kg/ha of 10-5-5 on April 1 and 375 kg/ha of 10-5-5 about June 1.
   3. Control - no fertilizer.

C. Design: Each treatment will be replicated three times per location at each of the locations. The treatment area will be 50 x 50 m.

D. Management: Fertilizer treatments will be repeated annually. No effort will be made to control any species against diseases or insects.

E. The following evaluations will be made: At the offset of the experiment, an inventory of the experiment will be conducted to record the number of species and the density of each of these species within a plot. A relative vigor rating will be given each species on a scale of 1-10 with 1 being best.

Twice during the first year, and three times during the second and third years, an inventory will be conducted on each plot, and the number and density of each invading species will be recorded, as well as the relative vigor for all species. This will include a determination of the vegetative spread of new or existing species. At the outset of the experiment, before fertilizer is applied, plant nutrient determinations will be made of representative profiles within the plot area. This will be repeated in September of the second and third year. Leaf sampling will be made in September of each year of the dominant species within each plot.

Table 1

Survival and vigor for five interplanted salt tolerant species growing on a sand dune, 1981[1]

Species	Survival 6-5	Survival 11-20	Vigor 6-5	Vigor 11-20
		R-I		
Elymus arenarius	73[2]	5	4[3]	4
E. vancouverensis	57	15	7	6
Carex kobomugi	70	44	8	6
C. arenaria	6	2	9	9
Panicum amarum	50	39	5	3
		R-II		
P. amarum	48	35	5	3
E. arenarius	77	14	4	4
C. arenaria	20	10	8	8
E. vancouverensis	52	23	5	5
C. kobomugi	62	35	6	6
		R-III		
E. vancouverensis	56	8	5	5
C. arenaria	3	0	9	10
P. amarum	34	33	6	4
C. kobomugi	65	44	6	6
E. arenarius	80	6	5	4

1/80 hills planted/accession/replication March 10 at Virginia Beach, Virginia; data recorded June 5 and November 20.

2/Number of hills surviving out of 80 planted.

3/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 2

Culm density based on count and visual observation for five interplanted salt tolerant species six months after planting on a sand dune, 1981[1]

	Replication						
	I		II		III		
Species	Culms [2]	Density [3]	Culms	Density	Culms	Density	Ave. Culms
Carex arenaria PI-02688T	0	10	10	8	0	10	3.3
C. kobomugi PI-433953	3	6	3	6	7	6	4.3
Elymus arenarius PI-348865	4	5	25	4	14	4	14.3
E. vancouverensis PI-421134	5	6	8	5	6	5	6.3
Panicum amarum PI-02773T	12	2	22	2	19	3	17.7

---

[1] 240 hills per accession planted near Virginia Beach, Virginia on March 10; Data recorded September 10.

[2] Number of culms growing in one meter of row.

[3] Relative rating for culm density based on visual observation of all rows; rating bounds 1-9 ; 1=Best.

Table 3

Relative rating for five interplanted salt tolerant species growing on a sand dune, 1981[1]

Rating	Replication I	Replication II	Replication III
Best[2]	Panicum amarum PI-02773T	P. amarum	P. amarum
2nd best	Elymus arenarius PI-348865	E. arenarius	E. arenarius
3rd best	E. vancouverensis PI-421134	E. vancouverensis	E. vancouverensis
4th best	Carex kobomugi PI-433953	C. kobomugi	C. kobomugi
Last	C. arenaria PI-02688T	C. arenaria	C. arenaria

[1] 240 hills per accession established near Virginia Beach, Virginia on March 10; Data recorded September 10.

[2] Rating based on cover, density, stand, spread and vigor.

Table 4

Survival and vigor for five interplanted salt tolerant species growing on a sand dune, 1981[1]

Species	Survival		Vigor	
	5-14	9-8	5-14	9-8
		R-I		
Carex arenaria	12[2]	5	8[3]	8
C. kobomugi	56	63	5	5
Elymus arenarius	80	44	3	4
E. vancouverensis	56	42	4	5
Panicum amarum	50	47	6	4
		R-II		
C. arenaria	14	5	8	9
C. kobomugi	35	55	6	3
E. arenarius	80	54	3	7
E. vancouverensis	58	41	5	5
P. amarum	28	53	5	4
		R-III		
C. arenaria	8	5	9	9
C. kobomugi	44	53	6	4
E. arenarius	80	74	3	4
E. vancouverensis	61	45	4	5
P. amarum	33	60.	5	3

---

[1] 80 hills planted/accession/replication near Fenwick, Delaware on April 1; data recorded May 14 and September 8.

[2] Number of hills surviving out of 80 planted.

[3] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 5

Culm density based on count and visual observation for five interplanted salt tolerant species five months after planting on a sand dune, 1981[1]

	Replication						
	I		II		III		
Species	Culms [2]	Density [3]	Culms	Density	Culms	Density	Ave. Culms
Carex arenaria PI-02688T	6	9	5	9	5	9	5.3
C. kobomugi PI-433953	8	5	4	5	4	5	5.3
Elymus arenarius PI-316233	7	6	5	7	11	4	7.7
E. vancouverensis PI-421 34	5	6	4	6	3	6	4.0
Panicum amarum PI-02773T	7	5	7	4	12	3	8.7

---

[1] 240 hills per accession planted near Fenwick, Delaware on April 1; Data recorded September 8.

[2] Number of culms growing in one meter of row.

[3] Relative rating for culm density based on visual observation of all rows; rating bounds 1-9; 1=Best.

Table 6

Relative rating for five interplanted salt tolerant species growing on a sand dune, 1981[1]

Rating	Replication I	Replication II	Replication III
Best[2]	Carex kobomugi PI-433953	C. kobomugi	Panicum amarum
2nd best	P. amarum PI-02773T	P. amarum	Elymus arenarius
3rd best	E. arenarius PI-316233	E. vancouverensis	C. kobomugi
4th best	E. vancouverensis PI-421134	E. arenarius	E. vancouverensis
Last	C. arenaria PI-02688T	C. arenaria	C. arenaria

---

[1] 240 hills per accession established near Fenwick, Delaware on April 1; Data recorded September 8.

[2] Ratings based on cover, density, stand, spread and vigor.

Table 7

Vigor for native woody species before and after applying fertilizer, 1981[1]

TREATMENT[2] Species	Replication					
	I		II		III	
	Dates					
	4-23	9-9	4-23	9-9	4-23	9-9
HIGH FERTILITY						
Acer rubrum	3[3]	3				
Ilex glabra	2	2	3	2	4	3
Liquidambar sp.	7	5				
Myrica spp.	3	3	4	4	5	4
Prunus serotina	2	2	5	5	5	4
Quercus virginiana			5	4	4	4
Rhus toxicodendron	4	5	6	5	6	6
Vaccinium corymbosum	3	4	3	3	5	5
MEDIUM FERTILITY						
Acer rubrum					6	5
Ilex glabra			4	2	4	3
Liquidambar sp.						
Myrica spp.	4	4	5	4	5	5
Pinus sp.			6	6		
Prunus serotina	3	3	6	5	5	5
Quercus virginiana	4	3	5	4		
Rhus toxicodendron	4	5	7	6	6	5
Vaccinium corymbosum	4	5	4	3	3	3

Table 7
(cont.)

Vigor for native woody species before and after applying fertilizer, 1981

TREATMENT Species	Replication					
	I		II		III	
	Dates					
	4-23	9-9	4-23	9-9	4-23	9-9
CONTROL						
Acer rubrum					5	5
Myrica spp.	3	3	4	5	5	5
Prunus serotina	4	5	3		4	
Quercus virginiana	3	4		5		5
Rhus toxicodendron	5	5	6	6	5	6
Vaccinium corymbosum	4	5	3	4	4	5

1/These are the native dominant species that provide 5% or more canopy cover on the observation dates at Virginia Beach, Virginia

2/Fertilizer rates: High - N=150 kg/ha; P+K=75 kg/ha, Medium - N=75 kg/ha; P+K=37.5 kg/ha, Control = None. Applied as split application on April 23 and July 8.

3/Vigor ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 8

Canopy provided by native woody species [1] before and after applying fertilizer, 1981

TREATMENT [2] Species	Replication I		Replication II		Replication III	
	Dates 4-23	9-9	4-23	9-9	4-23	9-9
HIGH FERTILITY						
Acer rubrum	5 [3]	5				
Ilex glabra	5	5	5	5	5	5
Liquidambar sp.	5	5				
Myrica spp.	25	25	30	30	55	55
Prunus serotina	35	35	25	25	20	20
Quercus virginiana			10	10	10	10
Rhus toxicodendron	15	15	5	5	5	5
Vaccinium corymbosum	10	10	25	25	5	5
Total canopy	30	35	45	50	40	45
MEDIUM FERTILITY						
Acer rubrum					5	5
Ilex glabra			5	5	10	10
Liquidambar sp.						
Myrica spp.	20	20	35	35	30	30
Pinus sp.			5	5		
Prunus serotina	50	50	15	15	20	20
Quercus virginiana	10	10	5	5		
Rhus toxicodendron	5	5	5	5	10	10
Vaccinium corymbosum	15	15	30	30	25	25
Total canopy	20	25	40	45	35	40

Table 8
(cont.)

Canopy provided by native woody species before and after applying fertilizer, 1981

TREATMENT Species	Replication					
	I		II		III	
	Dates					
	4-23	9-9	4-23	9-9	4-23	9-9
CONTROL						
Acer rubrum					5	5
Myrica spp.	35	35	30	25	40	35
Prunus serotina	45	45	35	35	35	35
Quercus virginiana	5	5				
Rhus toxicodendron	10	10	5	5	10	10
Vaccinium corymbosum	5	5	30	35	10	15
Total canopy	40	45	70	70	50	55

1/These are the dominant native species that provided 5% or more canopy cover on the observation dates at Virginia Beach, Virginia.

2/Fertilizer rates: High - N=150 kg/ha; P+K=75 kg/ha, Medium - N=75 kg/ha; P+K=37.5 kg/ha, Control = None. Applied as split application on April 23 and July 8.

3/Percent stand is average of two independent observers; averaged to nearest 5 percent.

Table 9

Vigor for native woody species before and after applying fertilizer, 1981[1]

TREATMENT[2] Species	Replication					
	I		II		III	
	Dates					
	5-15	9-8	5-15	9-8	5-15	9-8
HIGH FERTILITY						
Myrica spp.	4[3]	2	2	3	3	4
Pinus taeda	6	6	5	6	7	7
Rhus copallina		6				
R. toxicodendron	3	4	5	5		
Rubus sp.	3	5	5	5		
Vaccinium sp.	4		4	4	4	5
MEDIUM FERTILITY						
Myrica sp.	5	1	3	3	3	5
P. taeda	5	5	6	6	4	6
R. copallina	5	5				
R. toxicodendron	4	4	5	5		
Rubus sp.	3	5	4	5	3	5
Vaccinium sp.	3	3	4	4	4	5
CONTROL						
Acer sp.			4	6		
Myrica spp.	3	4	4	4	3	5
P. taeda	4	7	6	6	6	7
R. copallina						6
R. toxicodendron	5	4	5			
Rubus sp.			4	6		6
Vaccinium sp.	4	5	4	5	4	5

---

[1] These are the dominant native species that provided 5% or more canopy cover on the observation dates at Fenwick Island, Delaware.

[2] Fertilizer rates: High - N=150 kg/ha; P+K=75 kg/ha, Medium - N=75kg/ha; P+K=37.5 kg/ha, Control = None. Applied as split application on May 15 and July 8.

[3] Vigor ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 10

Canopy provided by native woody species [1]
before and after applying fertilizer, 1981

TREATMENT [2] Species	Replication I		Replication II		Replication III	
	Dates					
	5-15 [3]	9-8	5-15	9-8	5-15	9-8
HIGH FERTILITY						
Myrica spp.	40	60	55	65	50	45
Pinus taeda	10	10	10	5	20	15
Rhus copallina		5				
R. toxicodendron	30	20		5		
Rubus sp.	10	5	10	10		
Vaccinium sp.	10		25	15	30	40
Total canopy	40	55	30	30	10	10
MEDIUM FERTILITY						
Myrica spp.	40	45	40	60	40	35
P. taeda	10	10	15	10	40	30
R. copallina	5	10				
R. toxicodendron	25	15	15	5		
Rubus sp.	10	15	10	10		10
Vaccinium sp.	10	5	20	15	20	25
Total canopy	50	50	55	40	35	20
CONTROL						
Acer sp.				5		
Myrica spp.	80	75	40	40	55	45
P. taeda	5	10	20	15	10	20

Table 10
(cont.)

Canopy provided by native woody species before and after applying fertilizer, 1981

TREATMENT Species	Replication I		Replication II		Replication III	
	Dates 5-15	9-8	5-15	9-8	5-15	9-8
CONTROL(cont.)						
R. toxicodendron		5	10			
Rubus sp.			5	5		5
Vaccinium sp.	15	10	25	35	35	30
Total canopy	15	35	40	30	20	20

1/These are the dominant native species that provided 5% or more canopy cover on the observation dates at Fenwick Island, Delaware.

2/Fertilizer rates: High - N=150 kg/ha; P+K=75 kg/ha, Medium - N=75 kg/ha; P+K=37.5 kg/ha, Control = None. Applied as split application on May 15 and July 8.

3/Percent stand is average of two independent observers; averaged to nearest 5 percent.

Table 11

Soil analyses for a sand prior to applying fertility treatments[1/]

Plot/ Depth	pH	Element		
		Mg	P (Kg/ha)	K
Control				
0 - 15 cm	4.9	13	7	12
15 - 30 cm	5.0	13	8	10
30 - 45 cm	4.9	12	8	13
Low Fertility				
0 - 15 cm	4.9	12	5	10
15 - 30 cm	4.8	12	4	12
30 - 45 cm	5.0	14	7	11
High Fertility				
0 - 15 cm	4.9	14	8	9
15 - 30 cm	4.9	13	10	11
30 - 45 cm	5.0	12	7	16

1/Soil was a coarse sand on a back dune near Fenwick, Delaware. Sampled prior to applying fertilizer.

Table 12

Soil analyses for a sand prior to applying fertility treatments[1]

Plot/ Depth	pH	Element		
		Mg	P (kg/ha)	K
Control				
0 - 15 cm	5.0	18	4	15
15 - 30 cm	5.1	16	7	11
30 - 45 cm	5.2	13	3	15
Low Fertility				
0 - 15 cm	5.0	18	10	11
15 - 30 cm	5.2	18	6	11
30 - 45 cm	5.3	15	4	11
High Fertility				
0 - 15 cm	4.6	19	8	13
15 - 30 cm	5.0	16	6	11
30 - 45 cm	5.2	15	6	10

---

[1] Soil was a coarse sand on a fore dune near Virginia Beach, Virginia. Sampled prior to applying fertilizer.

Table 13

Soil analyses on a sand dune prior to planting five herbaceous species[1]

Location	pH	Mg	P (Kg/ha)	K
Fenwick, Delaware	5.1	9	10	7
Virginia Beach, Virginia	5.2	18	10	10

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[1] Soil is a coarse sand on a fore dune generally devoid of vegetation; sampled prior to planting or applying fertilizer.

Table 14

Leaf analyses of dominant woody species growing on a sand dune, 1981[1]

Species	Treatment[2]	Rep/Plot	N %	P %	K %	Ca %	Mn[3]	Fe[3]
Myrica spp.	High	I 1	2.23	0.06	0.96	0.57	90	146
" "	"	II 5	2.18	0.07	0.97	0.38	73	173
" "	"	III 7	2.14	0.06	0.97	0.32	39	166
" "	"	I A	1.54	0.05	0.88	0.58	147	73
" "	"	II A	1.90	0.06	0.86	0.82	303	115
" "	"	III A	1.88	0.06	0.95	0.80	603	148
Average			1.98	0.06	0.93	0.58	209	137
Myrica spp.	Low	I 2	2.01	0.05	0.79	0.46	76	120
" "	"	II 4	1.99	0.06	0.85	0.53	83	155
" "	"	III 8	1.91	0.05	0.76	0.48	94	163
" "	"	I B	1.62	0.04	0.81	0.79	670	113
" "	"	II B	1.67	0.05	0.80	0.61	126	90
" "	"	III B	1.69	0.06	0.96	0.75	446	110
Average			1.82	0.05	0.83	0.60	249	125
Myrica spp.	Control	I 3	2.06	0.04	0.84	0.78	189	138
" "	"	II 6	1.63	0.03	0.73	0.48	68	214
" "	"	III 9	1.78	0.04	0.73	0.48	86	183
" "	"	I C	1.82	0.04	0.89	0.82	651	138
" "	"	III C	1.67	0.05	0.81	0.67	387	169
Average			1.79	0.04	0.80	0.71	276	168
Vaccinium spp.	High	II 5	1.46	0.07	0.80	0.29	24	69
" "	"	III 7	1.61	0.08	0.84	0.27	25	75
Average			1.54	0.08	0.82	0.28	25	72
Vaccinium spp.	Low	II 2	1.28	0.06	0.73	0.26	26	61
" "	"	II B	1.18	0.07	0.69	0.60	98	50
" "	"	III B	1.20	0.06	0.77	0.54	61	46
Average			1.22	0.06	0.73	0.47	62	52
Vaccinium spp.	Control	I 3	0.84	0.04	0.68	0.66	59	51
" "	"	II 6	0.96	0.05	0.66	0.44	24	45
" "	"	III 9	0.79	0.04	0.69	0.49	33	64
" "	"	II C	0.99	0.06	0.77	0.68	58	45
Average			0.90	0.05	0.70	0.57	44	51

Table 14
(cont.)

Leaf analyses of dominant woody species growing on a sand dune, 1981

Species	Treatment	Rep/Plot		N %	P %	K %	Ca %	Mn	Fe
Prunus spp.	High	I	A	2.70	0.22	1.24	0.96	596	100
" "	"	II	A	2.66	0.16	0.98	0.62	402	179
" "	"	III	A	2.68	0.20	1.12	0.68	444	103
Average				2.68	0.19	1.11	0.75	481	127
Prunus spp.	Low	I	B	2.60	0.23	1.16	1.05	739	99
Prunus spp.	Control	I	C	2.01	0.15	1.11	1.09	1108	105
" "	"	II	C	2.05	0.18	1.21	0.82	496	88
" "	"	III	C	2.07	0.24	1.10	0.70	562	88
Average				2.04	0.19	1.14	0.87	722	94
Rubus spp.	Low	I	2	2.46	0.13	0.92	0.29	116	83
" "	"	II	4	2.44	0.14	1.07	0.24	112	88
Average				2.45	0.14	1.00	0.27	114	86
Pinus taeda	Low	III	8	1.56	0.12	0.87	0.13	85	89

1/Leaf samples were collected from the 2 dominant species in each plot on September 8 in Delaware and September 10 in Virginia.

2/Fertilizer treatments - High=930 kg/ha 16-8-8 in Virginia, 1,500 kg/ha 10-5-5 in Delaware; Low=465 kg/ha 16-8-8 in Virginia, 750 kg/ha 10-5-5 in Delaware; Control=No fertilizer.

3/Micrograms per gram.

TIDAL BANK STABILIZATION

Spartina alterniflora on a Tidal Bank

34I018F

During June of 1980, the 40 selected accessions were established on a sandy beach on the Wye Plantation in Queen Annes County, Maryland. The two upper hills in each row were planted above the normal high tide elevation. Approximately, three meters of beach were left between the planting and the normal low water line. The salt concentration of the water was 8.8 PPT at planting time. A controlled release fertilizer was placed in the planting hole at establishment and a soluble fertilizer was broadcast in late summer.

Very little growth was observed during the first month. PI-421208 appeared to be the outstanding accession. Erosion in Rep I and II was almost nil while Rep III was subjected to severe damage from wave action. Excessive wave action undercut the bank, however, the plant damage seems to be entirely due to abrasion of sand and water.

Between August and mid-November of 1980, a storm occurred which caused moderate damage to Rep I and severe damage to Rep II and Rep III. In Rep I, the debris was deposited nearly 0.5 meter higher than normal. Severe destruction of Rep II was due to the poor stand of existing plants. About 0.5 meter of the semi-vertical bank was lost in Rep III and except for a few subplots, only scattered plants remain.

During June of 1981, 11 kilograms of 10-10-10 fertilizer were applied to each replication. The plots did not fully recover from the winter and regrowth was rated as poor. PI-421208 which was considered outstanding in performance for 1980 was extensively grazed by animals during 1981. PI-T02816 now appears to be the best accession.

A considerable amount of erosion occurred during the fall of the year which severely weakened the planting leaving only about half of the accessions to offer any significant shore protection.

Table 1

Amount of regrowth on one-year-old *Spartina alterniflora*, 1981[1]

PI No.	Amount of Regrowth		PI No.	Amount of Regrowth	
	R-I	R-II		R-I	R-II
T-02804	Little[2]	V-sparse	421187	None	None
T-02808	Little	Sparse	421188	None	None
T-02809	Little	V-sparse	421190	Little	Sparse
T-02816	Moderate	Moderate	421192	Little	Sparse
421140	None	None	421195	None	None
421144	Sparse	None	421198	None	V-sparse
421145	Moderate	None	421199	V-sparse	None
421146	None	None	421200	None	V-sparse
421153	Little	None	421202	Moderate	None
421154	None	Little	421203	Sparse	Sparse
421159	V-sparse	None	421208	Moderate	Moderate
421162	V-sparse	None	421210	None	None
421163	V-sparse	Sparse	421219	V-little	V-sparse
421166	V-sparse	Sparse	421220	Moderate	V-sparse
421167	None	None	421221	V-sparse	V-sparse
421169	None	V-sparse	421224	Sparse	V-sparse
421172	None	None	421228	None	Sparse
421175	V-sparse	None	421230	V-sparse	Sparse
421184	None	None	421231	None	None
421185	V-sparse	None	421232	Sparse	None

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[1] 60 hills established/accession/replication on June 3, 1980; data recorded May 5.

[2] Rating order is: None, Very sparse, Sparse, Very little; Little; Moderate.

Table 2

Stand, vigor and amount of growth for 40 *Spartina alterniflora* accessions, 1981[1]

PI No./ Rep	Stand	Vigor	Growth	PI No./ Rep	Stand	Vigor	Growth
T-02804	[2]	[2]	[2]	421163			
I	8	6	9	I	8	6	8
II	9	6	9	II	5	5	6
T-02808				421166			
I	9	6	9	I	7	5	8
II	6	4	7	II	5	5	6
T-02809				421167			
I	7	6	7	I	9	7	9
II	8	6	9	II	7	6	8
T-02816				421169			
I	4	3	5	I	10	-	-
II	6	3	6	II	10	-	-
421140				421172			
I	10	-	-	I	8	6	9
II	10	-	-	II	9	6	8
421144				421175			
I	8	7	9	I	8	6	9
II	7	6	8	II	7	5	7
421145				421184			
I	7	4	7	I	9	8	9
II	9	6	9	II	4	6	7
421146				421185			
I	9	5	9	I	9	6	9
II	10	-	-	II	9	6	9
421153				421187			
I	7	7	9	I	7	4	8
II	9	5	8	II	8	6	9
421154				421188			
I	10	-	-	I	9	6	9
II	6	4	7	II	8	4	8
421159				421190			
I	8	7	9	I	9	7	9
II	9	6	9	II	10	-	-
421162				421192			
I	9	5	8	I	9	7	9
II	8	6	9	II	8	5	9

Table 2
(cont.)

Stand, vigor and amount of growth for 40 *Spartina alterniflora* accessions, 1981

PI No./ Rep	Stand	Vigor	Growth	PI No./ Rep	Stand	Vigor	Growth
421195				421219			
I	8	7	8	I	9	6	8
II	6	6	7	II	7	5	8
421198				421220			
I	9	7	9	I	7	5	7
II	9	6	9	II	7	6	8
421199				421221			
I	9	8	9	I	7	5	8
II	10	-	-	II	6	4	8
421200				421224			
I	8	7	9	I	8	5	8
II	6	5	7	II	8	4	8
421202				421228			
I	5	4	6	I	9	7	9
II	6	5	7	II	7	5	8
421203				421230			
I	8	6	8	I	7	6	8
II	7	5	7	II	7	5	8
421208				421231			
I	4	3	5	I	9	6	9
II	5	3	6	II	9	6	9
421210				421232			
I	9	7	9	I	7	4	8
II	7	6	8	II	9	6	9

1/60 hills established/accession/replication on June 3, 1980; data recorded June 10.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead or none.

Table 3

Characteristics for 40 *Spartina alterniflora* accessions, 1981[1]

PI No./ Rep	Stand	Vigor	Stems[2] (No.)	PI No./ Rep	Stand	Vigor	Stems (No.)
T-2804	[3]	[3]		421163			
I	4	3	32	I	5	2	11
II	8	4	24	II	4	1	18
T-2808				421166			
I	8	3	16	I	7	3	20
II	5	3	24	II	4	1	42
T-2809				421167			
I	7	5	9	I	9	-	3
II	7	2	9	II	6	2	23
T-2816				421169			
I	2	1	12	I	9	-	10
II	5	2	12	II	9	-	3
421140				421172			
I	9	6	4	I	7	3	21
II	10	-	-	II	8	4	15
421144				421175			
I	6	2	6	I	7	3	19
II	4	2	11	II	7	4	15
421145				421184			
I	6	4	16	I	8	4	11
II	8	4	11	II	6	4	42
421146				421185			
I	7	3	10	I	7	4	12
II	8	2	20	II	9	-	3
421153				421187			
I	6	3	15	I	5	2	18
II	6	3	17	II	7	2	15
421154				421188			
I	9	-	-	I	8	3	27
II	6	3	10	II	7	3	27
421159				421190			
I	9	-	7	I	8	-	9
II	8	4	15	II	8	4	17
421162				421192			
I	6	3	15	I	9	-	2
II	8	5	17	II	6	3	15

Table 3
(cont.)
Characteristics for 40 *Spartina alterniflora* accessions, 1981

PI No./ Rep	Stand	Vigor	Stems (No.)	PI No./ Rep	Stand	Vigor	Stems (No.)
421195				421219			
I	8	5	4	I	8	3	5
II	5	3	10	II	4	2	30
421198				421220			
I	8	4	12	I	6	3	16
II	8	4	13	II	4	2	31
421199				421221			
I	9	-	5	I	6	3	24
II	10	-	-	II	5	2	29
421200				421224			
I	6	2	17	I	6	2	31
II	5	2	21	II	7	4	14
421202				421228			
I	4	4	13	I	9	-	7
II	5	2	28	II	6	2	24
421203				421230			
I	5	2	19	I	5	3	33
II	7	3	11	II	6	2	21
421208				421231			
I	2	2	33	I	7	3	20
II	4	1	21	II	8	4	15
421210				421232			
I	9	-	1	I	5	3	26
II	6	2	19	II	9	-	4

1/60 hills established/accession/replication on June 3, 1980 at Wye Plantation; data recorded August 25.

2/Number of culms 5cm or more tall in an area 30 x 30 cm; most dense area selected for count.

3/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead or none.

Table 4

Plant size and bloom data for 40 *Spartina alterniflora* accessions, 1981[1]

PI No./ Rep	Seedhead Stage	Plant Dimensions (cm)	PI No./ Rep	Seedhead Stage	Plant Dimensions (cm)
T-2804	[2]	[3]	421163		
I	B	55-40x23	I	V	-70x20
II	B	60-45x18	II	V	-55x13
T-2808			421166		
I	V	48-33x12	I	B	50-50x12
II	B	70-45x20	II	V	-30x10
T-2809			421167		
I	V	-40x22	I	V	-13x11
II			II	B	50-60x10
T-2816			421169		
I	B	120-80x15	I	B	45-15x12
II	V	-65x11	II	B	14-28x24
421140			421172		
I	V	-40x7	I	B	65-55x10
II	V		II	B	60-30x14
421144			421175		
I	V	-50x15	I	B	55-17x10
II	V	-35x24	II	B	30-45x20
421145			421184		
I	V	-40x35	I	B	55-42x20
II	V	-30x15	II	B	75-40x12
421146			421185		
I	V	-60x16	I	B	50-35x20
II	V	-40x20	II	B	70-29x14
421153			421187		
I	V	-55x15	I	B	90-70x14
II	V	-40x20	II	B	85-65x22
421154			421188		
I	V		I	B	55-50x15
II	B	75-55x15	II	B	80-40x14
421159			421190		
I	B	14-20x12	I	B	60-33x7
II	B	17-45x19	II	B	50-45x8
421162	B	55-40x20	421192		
I			I	V	-28x4
II	B	50-30x18	II	V	-33x19

Table 4
(cont.)

Plant size and bloom data for 40 *Spartina alterniflora* accessions, 1981

PI No./ Rep	Seedhead Stage	Plant Dimensions	PI No./ Rep	Seedhead Stage	Plant Dimensions
421195			421219		
I	V	-20x9	I	B	60-32x10
II	B	60-50x12	II	V	-45x19
421198			421220		
I	B	45-30x10	I	B	70-70x20
II	B	42-30x20	II	V	-55x20
421199			421221		
I	V	-33x9	I	B	85-55x10
II	-		II	V	-50x8
421200			421224		
I	B	65-60x13	I	B	100-55x16
II	B	80-65x7	II	B	80-45x13
421202			421228		
I	B	95-70x20	I	V	-20x11
II	B	63-43x15	II	P	75-50x15
421203			421230		
I	B	85-60x12	I	B	75-60x29
II	P	85-65x10	II	B	60-50x15
421208			421231		
I	V	-75x20	I	B	55-29x19
II	V	-45x18	II	B	60-36x20
421210			421232		
I	V	-12x13	I	B	70-45x25
II	V	-50x13	II	V	-45x10

1/60 hills established/accession/replication on June 3, 1980 at Wye Plantation; data recorded August 25.

2/Legend: V=Vegetative stage; B=Blooming; P=Past bloom and into seed formation phase.

3/Legend: Order of measurements are: seedhead height - leaf height x hill width; expressed in centimeters.

Table 5

Vegetative cover afforded by 40 *Spartina alterniflora* accessions on a tidal bank, 1981[1]

Accession	Cover[2]		Accession	Cover	
	R-I[3]	R-II		R-I	R-II
T-02804	Mo	N	PI-421187	S	S
T-02808	F	F	PI-421188	N	S
T-02809	Mo	N	PI-421190	N	N
T-02816	Mu	Mo	PI-421192	N	F
PI-421140	N	N	PI-421195	N	N
PI-421144	S	F	PI-421198	N	N
PI-421145	S	N	PI-421199	S	N
PI-421146	N	N	PI-421200	S	S
PI-421153	Mo	S	PI-421202	F	S
PI-421154	S	S	PI-421203	F	N
PI-421159	N	N	PI-421208	Mu	F
PI-421162	F	S	PI-421210	N	N
PI-421163	F	S	PI-421219	S	S
PI-421166	S	S	PI-421220	F	F
PI-421167	N	N	PI-421221	S	S
PI-421169	N	N	PI-421224	F	S
PI-421172	N	N	PI-421228	N	S
PI-421175	N	S	PI-421230	S	N
PI-421184	S	S	PI-421231	S	S
PI-421185	N	S	PI-421232	S	N

---

[1] 60 hills established/accession/replication on June 3; data recorded April 2, 1981.

[2] Amount of foliage providing protective cover.

[3] N=None; S=Sparse; F=Fair; Mo=Moderate; Mu=Much.

Table 6

Vegetative cover afforded by 40 *Spartina alterniflora* accessions on a tidal bank, 1981[1]

Accession	Cover[2] R-I	Cover[2] R-II	Accession	Cover[2] R-I	Cover[2] R-II
T-02804	8[3]	9	PI-421187	8	9
T-02808	9	7	PI-421188	9	9
T-02809	9	9	PI-421190	10	9
T-02816	4	6	PI-421192	10	9
PI-421140	10	10	PI-421195	10	8
PI-421144	7	8	PI-421198	10	9
PI-421145	7	9	PI-421199	9	10
PI-421146	8	9	PI-421200	7	7
PI-421153	7	8	PI-421202	6	8
PI-421154	10	8	PI-421203	8	9
PI-421159	9	9	PI-421208	3	6
PI-421162	7	9	PI-421210	10	9
PI-421163	7	6	PI-421219	9	7
PI-421166	8	7	PI-421220	7	8
PI-421167	10	9	PI-421221	7	7
PI-421169	10	10	PI-421224	7	8
PI-421172	9	10	PI-421228	10	7
PI-421175	9	9	PI-421230	7	9
PI-421184	9	7	PI-421231	9	9
PI-421185	9	10	PI-421232	7	9

---

[1] 60 hills established/accession/replication on June 3, 1980 at Wye Plantation; data recorded December 10.

[2] Amount of foliage providing protective cover.

[3] Relative rating: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Table 7

Best accessions out of 40 *Spartina patens* growing on a tidal bank, 1981[1]

R-I[2]	R-II[2]
PI-T-02816	PI-421163
PI-421202	PI-421166[3]
PI-421208[3]	PI-421219
PI-421224	PI-421220
PI-421230	PI-421221

Table 8

Best accessions out of 40 *Spartina patens* growing on a tidal bank, 1981

R-I[2]	R-II[2]
PI-T-02816	PI-T-02808
PI-421202	PI-T-02816
PI-421208[3]	PI-421163[3]
PI-421221	PI-421208
PI-421224	PI-421221

---

[1] 60 hills established/accession/replication on June 3, 1980 at Wye Plantation; data recorded on **August** 25 for Table 7 and December 10 for Table 8.

[2] Best five accessions in respective replication and listed in numerical order. Rating based on cover, stand, amount of foliage and erosion control.

[3] Best accession in replication.

Advanced Evaluation of Spartina patens

34F015F

Numerous acres of valuable land are lost annually along the mid-Atlantic coast. This drastic loss of land is attributed to the impact that severe storms, fluctuating water levels and boat wakes have upon tidal estuaries and coastal sand banks. Soils on these banks are variable ranging from light sand to heavy clays. The land behind these banks includes agricultural property, estates and high density developments. There is sufficient evidence from the presence of natural stands that vegetation is capable of growing on the beach adjacent to the banks and protecting the banks from further erosion. The height of these banks varies from two feet to more than fifty feet. The Cape May PMC has directed its efforts toward sites that have less than a ten foot sloped bank. Superior plant varieties are not readily available and planting techniques have not been adequately tested for the stabilization of this type of erosion.

In 1976, the Cape May PM Team collected 78 accessions of Spartina patens (saltmeadow cordgrass) along the coastal areas from Massachusetts to Georgia. The 15 best accessions were selected for detailed evaluation. These were established on the center and on an exposed tidal bank along the Choptank River near Trappe, Maryland. The amount of growth was very sparse during the first 30 days after planting. In fact, the plants made little growth or spread during the first year but did become well established.

Based on the 1978 data taken from the Trappe, Maryland planting and the on-center plots, ten of the best accessions were selected for additional testing. The ten selections were used to establish two new plantings in 1979, one of which was destroyed by summer storms. Using potted plants, a planting was established behind a breakwater along the Delaware Bay at Pickering Beach, Delaware. This planting made rapid growth early in the season but was subjected to considerable wave action because of the long fetch. While the data from this planting was more valid than from the first year results at Trappe, Maryland, the mortality for the potted plants was high.

During 1980, five of the ten accessions were selected for advanced testing. A fine-stemmed prostrate strain from the Americus PMC (source NC) was added to the project. Three new tidal bank areas, subjected to erosion caused by wave action, were planted using these six S. patens strains. These plantings are located in Wareham, Massachusetts; Nags Head, North Carolina; and Virginia Beach, Virginia.

The planting located at Wareham, Massachusetts exhibited very poor survival and growth. Soil cover was rated ineffective for the entire planting. The salt content for this planting site is excessively high. Persistent wave action caused some damage to a portion of the Nags Head, North Carolina planting. The Virginia Beach Planting was very successful. In fact, three fine-stemmed accessions had good survival, and it would be very difficult to visually select the best one.

One entire replication of the Nags Head, North Carolina Planting was destroyed in 1980 due to severe wave action. Parts of Rep I and II were also affected. This wave action was created by wind rather than lunar which is uncommon.

Three additional plantings of *S. patens* were made in 1981. One is located near Warsaw, Virginia; another at Suffolk County Park in Long Island, Yew York. The third planting was established on the Chesapeake Bay in Kent County, Maryland. Potted plants were used.

The Long Island Planting suffered severe pedestrian damage early in the season. Two-thirds of the plants in Rep I and one-half of the plants in Rep II and Rep III were destroyed by campers and sunbathers. The use of a sand fence to enclose the planted area would probably have prevented most of the destruction and allowed the planting to become fully established.

Table 1

Evaluations for 6 accessions of *Spartina patens* on a tidal area, 1981 1/

PI No.	Survival 2/	Vigor 3/	Rust Disease 4/	Leaf Texture 5/	Seedheads
Rep I					
421237	83	4	Sl	M	None
421238	60	3	Sl	M	Many
421239	68	4	M	M	Few
421250	63	3	M	C	None
421262	72	3	M	C	None
434390	65	4	Sl	F	Many
Rep II					
421237	87	1	N	M	Few
421238	76	3	M	M	Many
421239	96	3	M	M	Few
421250	94	3	Sl	C	None
421262	96	3	Se	C	None
434390	90	3	N	F	Many
Rep III					
421237	97	4	Sl	M	Few
421238	89	6	Sl	M	Many
421239	93	5	Se	M	Few
421250	88	4	Sl	C	None
421262	94	5	Se	C	None
434390	95	5	M	F	Many

1/Six rows/accession/replication using 16 plants per row were established at Echo Hill Camp, Chestertown, Maryland on June 3; data recorded August 21.

2/Survival - No. of plants alive; survival for Rep I is affected by erosion at rear of plots.

3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor.

4/Ratings are - N=None; Sl=Slight; M=Moderate; Se=Severe.

5/Leaf Texture - F=Fine; M=Medium; C=Coarse.

Table 2

Evaluation for six accessions of *Spartina patens* on a tidal area, 1981[1]

PI No.	Survival[2]	Vigor[3]	Rust Disease[4]
Rep I			
421237	71	4	6
421238	60	4	3
421239	64	3	4
421250	63	5	4
421262	72	3	7
434390	66	4	3
Rep II			
421237	68	1	6
421238	71	3	7
421239	96	4	6
421250	94	4	8
421262	96	5	7
434390	92	2	3
Rep III			
421237	96	5	4
421238	75	7	5
421239	93	5	6
421250	87	5	6
421262	93	6	7
434390	95	4	3

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[1] Six rows/accession/replication, using 16 plants per row, were established at Echo Hill Camp, Chestertown, Maryland on June 3; data recorded September 29.

[2] Number of plants alive.

[3] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

[4] Ratings: 1=None; 5=Moderate; 9=Severe.

Table 3

Relative rating for six accessions of *Spartina patens* growing on a tidal area, 1981[1]

	REP I	REP II	REP III
Best	PI-421262	PI-421237	PI-421237
2nd best	PI-434390	PI-434390	PI-421250
3rd best	PI-421238	PI-421238	PI-421262

Average survival and vigor by accession for three replications of *Spartina patens*

Accession	Survival (%)	Vigor
PI-421237	98	2.7
PI-421262	99	3.3
PI-434390	99	3.7
PI-421250	95	4.0
PI-421238	94	4.1
PI-421239	96	4.3
Average	97	3.7

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[1] Planting established June 3 at Echo Hill Camp, Chestertown, Maryland; data recorded on August 4.

Table 4

Soil cover and stem density for six accessions of Spartina patens on a tidal area, 1981 1/

PI No.	Percent Soil Cover 2/	Stem Density 3/ 1	2	3	Average Stem Density
		REP I			
421237	50	130	86	125	113
421238	40	51	75	82	69
421239	60	48	87	77	71
421250	30	66	54	62	61
421262	70	68	148	74	97
434390	55	80	119	123	107
		REP II			
421237 4/	95	114	135	239	163
421238 4/	75	102	118	128	116
421239	60	62	64	69	65
421250	50	53	45	76	58
421262	60	51	102	66	73
434390 4/	75	124	174	168	155
		REP III			
421237	50	60	90	139	96
421238	30	52	56	102	70
421239	45	45	43	49	46
421250	45	46	44	51	47
421262	35	59	63	67	63
434390	60	76	119	125	107

1/Six rows/accession/replication using 16 plants per row were established at Echo Hill Camp, Chestertown, Maryland on June 3; data recorded on October 21.

2/Visual observation of the percent of the total plot which is being covered by vegetation from the designated accession.

3/Stem density - The number of stems for three designated hills.

4/Stem density is believed to be influenced by increased moisture and possibly some organic matter.

Table 5

Relative ratings for six accessions of *Spartina patens* on a tidal area, 1981[1]

	R-I	R-II	R-III
Best[2]	PI-421262	PI-421237	PI-434390
2nd best	PI-421239	PI-421238	PI-421239
3rd best	PI-421237	PI-434390	PI-421237

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[1] Planting installed at Chestertown, Maryland on June 3; data recorded October 21.

[2] Ratings based on amount of growth, vigor and ground cover.

Table 6

Dormancy stage for six Spartina patens accessions on a tidal area, 1981[1]

Accession	Source	Percent Dormancy[2]			
		Oct. 29	Nov. 13	Nov. 25	Dec. 8
		REP I			
PI-421262	MA	10	30	90	95
PI-421250	NJ	30	60	75	95
PI-421238	NC	10	30	40	50
PI-434390	NC	15	20	30	75
PI-421239	NC	10	20	40	65
PI-421237	NJ	10	40	80	90
		REP II			
PI-421238	NC	10	20	40	70
PI-421237	NJ	10	25	60	85
PI-434390	NC	10	15	30	50
PI-421250	NJ	20	80	95	95
PI-421262	MA	30	75	90	95
PI-421239	NC	20	40	50	95
		REP III			
PI-421250	NJ	30	75	90	90
PI-421239	NC	10	60	80	90
PI-421262	MA	20	80	85	95
PI-421237	NJ	50	60	75	95
PI-434390	NC	10	25	40	75
PI-421238	NC	10	30	50	85

---

[1] Six rows/accession/replication using 16 plants per row were established at Echo Hill Camp, Chestertown, Maryland on June 3.

[2] Percentage of foliage which is dormant (i.e., amount of foliage that is not green).

Table 7

Evaluation for six accessions of *Spartina patens* growing on a tidal area, 1981[1]

	Survival				
	Upper 2 Rows (12 plants) Competition	Middle 4 Rows (24 plants) Normal Site	Bottom 10 Rows (60 plants) Tidal Area	Total (96 plants)	Vigor[2]
			R-I		
PI-421262 No. (Pct.)	8 (67)	24 (100)	33 (55)	65 (68)	4
PI-421250 No. (Pct.)	4 (33)	23 (96)	20 (33)	47 (49)	5
PI-421238 No. (Pct.)	10 (83)	24 (100)	21 (35)	55 (57)	5
PI-434390 No. (Pct.)	12 (100)	23 (96)	36 (60)	71 (74)	4
PI-421239 No. (Pct.)	9 (75)	21 (87)	20 (33)	50 (52)	6
PI-421237 No. (Pct.)	12 (100)	24 (100)	27 (45)	63 (66)	3

Table 7
(cont.)

Evaluation for six accessions of Spartina patens growing on a tidal area, 1981

	Survival				
	Upper 2 Rows (12 plants) Competition	Middle 4 Rows (24 plants) Normal Site	Bottom 10 Rows (60 plants) Tidal Area	Total (96 plants)	Vigor
		R-II			
PI-421238 No. (Pct.)	10 (83)	22 (92)	20 (33)	52 (54)	5
PI-421237 No. (Pct.)	12 (100)	23 (96)	14 (23)	49 (51)	3
PI-434390 No. (Pct.)	12 (100)	23 (96)	32 (53)	67 (70)	3
PI-421250 No. (Pct.)	10 (83)	22 (92)	30 (50)	62 (65)	5
PI-421262 No. (Pct.)	11 (92)	24 (100)	33 (55)	68 (71)	4
PI-421239 No. (Pct.)	10 (83)	22 (92)	24 (40)	56 (57)	4

Table 7
(cont.)

Evaluation for six accessions of *Spartina patens* growing on a tidal area, 1981

	Survival				
	Upper 2 Rows (12 plants) Competition	Middle 4 Rows (24 plants) Normal Site	Bottom 10 Rows (60 plants) Tidal Area	Total (96 plants)	Vigor
		R-III			
PI-421250 No. (Pct.)	9 (75)	19 (80)	20 (33)	48 (50)	6
PI-421239 No. (Pct.)	9 (75)	23 (96)	16 (27)	48 (50)	5
PI-421262 No. (Pct.)	12 (100)	24 (100)	25 (42)	61 (64)	5
PI-421237 No. (Pct.)	12 (100)	24 (100)	16 (27)	52 (54)	3
PI-434390 No. (Pct.)	12 (100)	23 (96)	24 (40)	59 (61)	4
PI-421238 No. (Pct.)	12 (100)	18 (75)	18 (30)	48 (50)	5

1/Planting established May, 1981 at Carter Wellford's, Warsaw, Virginia; data recorded July 13.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 8

Average survival and vigor for three replications of *Spartina patens*, 1981[1]

	Upper 2 Rows (12 plts)	Middle 4 Rows (24 plts)	Bottom 10 Rows (60 plts)	Total	Vigor
PI-434390 No. (Pct.)	12.00 (100)	23.00 (96)	30.67 (51)	65.6 (68)	3.7
PI-421262 No. (Pct.)	10.33 (86)	24.00 (100)	30.33 (51)	64.66 (68)	4.3
PI-421237 No. (Pct.)	12.00 (100)	23.67 (99)	19.00 (32)	54.67 (57)	3.0
PI-421250 No. (Pct.)	7.67 (64)	21.33 (89)	23.33 (39)	52.33 (55)	5.3
PI-421238 No. (Pct.)	10.67 (88)	21.33 (89)	19.67 (33)	51.67 (53)	5.0
PI-421239 No. (Pct.)	9.33 (77)	22.00 (92)	20.00 (33)	51.30 (53)	5.0

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[1] Planting established May, 1981 at Carter Wellford's, Warsaw, Virginia.

Table 9

Characteristics for six *Spartina patens* growing on a tidal bank, 1981[1]

PI No./ Rep	Culms/hill[2]	Seedheads	Foliage	Cover (%)
421237 I	57 220	10[3]	2[3]	75
II	55 185	10	3	50
III	41 173	10	2	70
421238 I	39 134	5	6	40
II	15 145	3	4	45
III	29 116	3	4	45
421239 I	66 178	8	5	50
II	45 140	5	2	70
III	18 123	5	5	50
421250 I	44 128	7	6	45
II	40 105	10	4	50
III	32 111	10	5	45

Table 9
(cont.)

Characteristics for six *Spartina patens* growing on a tidal bank, 1981

PI No./ Rep	Culms/hill	Seedheads	Foliage	Cover (%)
421262				
I	92 94	10	4	60
II	40 100	10	4	55
III	26 121	7	3	60
434390				
I	85 349	4	3	70
II	65 290	4	3	60
III	45 244	3	3	60

1/96 potted plants were planted May 20 at **Carter Wellford Farm**; data recorded August 26.

2/Two hills were randomly selected, representing the largest and smallest in the top four rows.

3/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor or very few; 10=None.

Table 10

Survival for six accessions of *Spartina patens* growing on a tidal bank, 1981 1/

Accession/ Replication	Survival - Surv/Planted (Pct.) Above High Tide	Below High Tide	Total
PI-434390			
I	29/30 (97%)	16/18 (88%)	45/48 (94%)
II	22/24 (92%)	23/30 (77%)	45/54 (83%)
III	30/30 (100%)	21/24 (90%)	51/54 (94%)
Avg.	96%	85%	90%
PI-421237			
I	29/30 (97%)	10/18 (55%)	39/48 (81%)
II	24/24 (100%)	15/30 (50%)	39/54 (72%)
III	30/30 (100%)	13/24 (54%)	43/54 (80%)
Avg.	99%	53%	78%
PI-421239			
I	18/18 (100%)	14/24 (58%)	32/42 (76%)
II	28/30 (93%)	27/30 (90%)	55/60 (91%)
III	27/30 (90%)	22/30 (73%)	49/60 (81%)
Avg.	94%	74%	83%
PI-421262			
I	30/30 (100%)	28/36 (77%)	58/66 (88%)
II	28/30 (93%)	35/42 (83%)	63/72 (88%)
III	26/30 (87%)	25/30 (83%)	51/60 (85%)
Avg.	93%	81%	87%
PI-421238			
I	30/30 (100%)	12/24 (50%)	42/54 (80%)
II	21/24 (88%)	13/24 (54%)	34/48 (71%)
III	25/30 (83%)	8/18 (44%)	33/48 (70%)
Avg.	90%	49%	74%
PI-421250			
I	28/30 (93%)	15/30 (50%)	43/60 (72%)
II	24/24 (92%)	28/36 (77%)	52/60 (87%)
III	22/30 (73%)	17/30 (57%)	39/60 (65%)
Avg.	86%	61%	71%
All Accessions			
Replication I	98%	63%	82%
Replication II	94%	55%	82%
Replication III	89%	67%	78%
Average	94%	62%	81%

1/ Planting established May 20, 1981 at Carter Wellford Farm, Virginia; data recorded October 29.

Table 11

Evaluation for six accessions of *Spartina patens* growing on a tidal area, 1981[1]

PI No./ Rep	Cover[2] (%)	Dormancy[3] (%)	Vigor
434390			
I	70	5	3[4]
II	60	20	3
III	60	5	3
Avg.	63	10	3.0
421237			
I	60	35	4
II	65	30	4
III	80	25	2
Avg.	68	30	3.3
421239			
I	55	25	4
II	70	10	1
III	40	10	4
Avg.	55	15	3.0
421262			
I	60	35	4
II	50	40	5
III	70	30	3
Avg.	60	35	4.0
421238			
I	35	25	5
II	45	5	5
III	40	5	3
Avg.	40	10	4.3
421250			
I	40	15	4
II	40	25	4
III	30	5	5
Avg.	37	15	4.3
All Accessions			
Replication I	53	23	4.0
Replication II	55	22	3.7
Replication III	53	13	3.3
Average	54	19	3.7

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[1] Planting established May 20, 1981 at Carter Wellford Farm, Virginia; data recorded October 29.

[2] Cover evaluated on plants above mean high tide line.

[3] Dormancy evaluated as percent of leaves dormant on plants above mean high tide line.

[4] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 12

Dormancy stage for six accessions of *Spartina patens*, 1981[1]

PI No./ Rep	Origin	Oct. 29	Nov. 12	Nov. 25
421262	MA			
I		35	60	95
II		40	30	75
III		30	25	80
Avg.		35%	38%	83%
421237	NJ			
I		35	35	75
II		30	60	95
III		25	20	75
Avg.		30%	38%	82%
421250	NJ			
I		15	20	65
II		25	55	85
III		5	55	95
Avg.		15%	43%	82%
421238	NC			
I		25	40	70
II		5	25	85
III		5	30	60
Avg.		12%	32%	72%
421239	NC			
I		25	25	60
II		10	15	70
III		10	20	65
Avg.		15%	20%	65%
434390	NC			
I		5	20	50
II		20	50	75
III		5	30	55
Avg.		10%	33%	60%

---

[1] Planting established May 20, 1981 at Carter Wellford Farm.

Table 13

Survival and vigor for six accessions of Spartina patens, 1981[1]

PI No./ Rep	Origin	Survival No.	Vigor
421237	NJ		[2]
I		13	9
II		88	4
III		43	7
421238	NC		
I		45	6
II		45	8
III		34	6
421239	NC		
I		8	9
II		49	5
III		56	6
421250	NJ		
I		27	6
II		55	3
III		65	4
421262	MA		
I		43	5
II		70	5
III		70	5
434390	NC		
I		33	8
II		45	7
III		31	7

---

[1] Six rows of each accession, using 16 potted plants per row, were replicated three times. Planting established June 11 at Suffolk County Park in West Hampton, Long Island, New York; data recorded July 30.

[2] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor. (Vigor ratings are reflected by people damage to plants.)

Table 14

Evaluation for six accessions of *Spartina patens* growing on a tidal area, 1981[1]

Acc./Rep	No. of Culms[2]	Rhizome Spread (cm)[3]	Vigor[4]	Foliage Production[4]	Seed-heads[4]
Rep I					
421237	12-10	20	7	9	10
421238	13-18	17	5	5	6
421239	- -	-	-	-	-
421250	20-23	11	6	7	10
421262	14-23	23	6	7	10
434390	13-29	20	6	6	10
Rep II					
421237	32-51	17	4	5	10
421238	12-27	18	4	4	6
421239	13-23	25	4	5	10
421250	14-22	11	5	5	10
421262	30-15	19	4	6	10
434390	20-25	15	5	6	9
Rep III					
421237	7-7	24	7	8	10
421238	20-31	16	4	5	3
421239	12-17	15	7	8	10
421250	7-18	10	5	7	10
421262	13-20	17	6	7	10
434390	20-16	14	5	6	10

---

[1] Planting established June 11 at Suffolk County Park in West Hampton, Long Island, New York; data recorded October 8.

[2] Number of culms/hill for two plants.

[3] Total rhizome spread at widest point.

[4] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Table 15

Relative rating for six accessions of *Spartina patens* growing on a tidal area, 1981[1]

	R-I	R-II	R-III
Best[2]	PI-421238	PI-421238	PI-421238
2nd Best	PI-421250	PI-421239	PI-434390
3rd Best	PI-434390	PI-421237	PI-421262

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[1] Planting established June 11 at Suffolk County Park in West Hampton Beach, Long Island, New York; data recorded October 8.

[2] Ratings: Based on stand, growth and vigor.

Table 16

Winter evaluation for a *Spartina patens* assembly on a tidal area, 1981[1]

PI No./ Rep	Ability to Provide Ground Cover	Stem Position[2]	Best Accession
421237			
I	Good-excellent	Semi-erect	X
II	Fair	Semi-erect	X
III	Fair	Semi-erect	
421238			
I	Fair	Erect	
II	Fair	Erect	
III	Fair	Erect	
421239			
I	Fair	Erect	
II	Fair	Erect	
III	Fair	Erect	
421250			
I	Fair-good	Erect	
II	Fair	Erect	
III	Fair	Erect	
421262			
I	Fair-good	Prostrate	
II	Fair	Prostrate	
III	Fair-good	Upright	
434390			
I	Fair	Semi-erect	
II	Fair	Semi-erect	
III	Fair-good	Semi-erect	X

1/Planting established May 22, 1980 at Virginia Beach, Virginia; data recorded February 10.

2/Stem position after plant subjected to winter weather.

Table 17

Four characteristics for *Spartina patens* growing on a tidal bank, 1981[1]

Accession/ Replication	Spread[2]	Vigor[3]	Regrowth[4]	Cover[5]
PI-421237				
I	6	2	2[3]	3[3]
II	4	3	3	3
III	3	2	3	3
PI-421238				
I	5	2	2	2
II	6	3	3	3
III	6	2	2	4
PI-421239				
I	8	3	3	5
II	6	2	2	4
III	6	2	2	4
PI-421250				
I	7	3	3	5
II	6	3	3	5
III	7	2	4	6
PI-421262				
I	4	3	3	4
II	2	3	2	3
III	3	3	4	3
PI-434390				
I	5	3	3	2
II	4	4	3	3
III	3	2	3	3

---

[1] 108 hills/accession/replication established May 22, 1980 at Virginia Beach, Virginia; data recorded April 27.

[2] Spreading of plants from original hills - 1=No hills or rows visible; 5=Row outline visible; 9=Individual hills visible.

[3] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor.

[4] Amount of regrowth includes both new growth in the hills and new culms between the hills.

[5] Effective sand cover based on total amount of foliage and density of culms over the plot.

Table 18

Vigor, stand and sand cover for six accessions 1/ of *Spartina patens* growing on a tidal bank, 1981

PI No./ Rep	Vigor	Stand	Cover
PI-421237	2/	2/	2/
I	3	1	2
II	3	3	4
III	3	2	4
PI-421238			
I	2	2	2
II	2	2	2
III	2	3	2
PI-421239			
I	2	4	2
II	2	3	3
III	3	3	3
PI-421250			
I	3	4	5
II	4	3	4
III	3	4	4
PI-421262			
I	5	3	4
II	5	3	5
III	5	3	4
PI-434390			
I	4	3	4
II	4	3	4
III	4	3	4

1/108 hills/accession/replication established May 22, 1980 at Virginia Beach, Virginia; Data recorded September 14.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

AVAILABLE

Table 19

Stem density, seed production and stand uniformity for six Spartina patens accessions growing on a tidal bank, 1981[1]

PI No./ Rep	Stems (No.)	Seed Production	Stand (Uniformity)
PI-421237	[2]	[3]	[4]
I	284	10	No
II	232	10	Yes
III	426	10	Yes
PI-421238			
I	269	3	Yes
II	189	3	No
III	274	1	Yes
PI-421239			
I	195	1	No
II	223	1	Yes
III	321	1	No
PI-421250			
I	191	5	No
II	221	5	Yes
III	233	5	Yes
PI-421262			
I	140	10	No
II	199	10	No
III	185	10	Yes
PI-434390			
I	190	10	No
II	272	10	No
III	182	5	No

---

[1] Planting established on May 22, 1980 at Virginia Beach, Virginia; data recorded September 14.

[2] Number of stems growing in an area 30 cm x 30 cm; count area selected at random.

[3] Ratings are: 1=Many; 3=Moderate; 5=Average; 7=Few; 9=Very Few; 10=None.

[4] Distribution of stems in a uniform stand within count area.

Table 20

Relative rating for six *Spartina patens*, 1981[1]

	R-I	R-II	R-III
Best[2]	PI-421239	PI-421238	PI-434390
2nd best	PI-421238	PI-421237	PI-421237
3rd best	PI-434390	PI-434390	PI-421238

---

[1] 108 hills planted/accession/replication May 22, 1980 at Virginia Beach, Virginia; data recorded September 14.

[2] Best accession selected on visual observation for vigor, cover, amount of growth and intended purpose.

Table 21

Four characteristics for *Spartina patens* growing on a tidal bank, 1981[1]

Accession/ Replication	Spread[2]	Vigor[3]	Regrowth[4]	Cover[5]
PI-421237				
I	3	2	3[3]	4[3]
II	1	1	2	2
PI-421238				
I	5	4	2	2
II	4	4	3	4
PI-421239				
I	5	3	2	3
II	6	5	4	5
PI-421250				
I	7	3	5	6
II	2	3	5	7
PI-421262				
I	2	2	6	7
II	3	4	7	6
PI-434390				
I	4	3	2	2
II	3	2	2	2

---

[1] 108 hills/accession/replication established May 4, 1980 at Nags Head, NC; Data recorded April 28.

[2] Spreading of plants from original hills - 1=No hills or rows visible; 5=Row outline visible; 9=Individual hills visible.

[3] Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

[4] Amount of regrowth included both new growth within the hills and new culms between the hills.

[5] Effective sand cover based on total amount of foliage and density of culms over the plot.

Table 22

Four characteristics for *Spartina patens* growing on a tidal bank, 1981[1]

Accession/ Replication	Stand	Vigor	Disease Injury	Cover[2]
PI-421237	[3]	[3]	[4]	[3]
I	4	3	1	2
II	2	3	2	2
PI-421238				
I	1	2	2	1
II	2	2	2	1
PI-421239				
I	3	3	2	3
II	1	1	2	1
PI-421250				
I	3	3	1	3
II	5	2	2	3
PI-421262				
I	3	4	3	3
II	2	2	2	2
PI-434390				
I	2	2	2	2
II	2	2	3	2

---

[1] Planting established May 4, 1980 at Nags Head, NC; data recorded September 16.

[2] Effective sand cover based on total amount of foliage and density of culms over the plot.

[3] Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

[4] Ratings are: 1=None; 3=Little injury; 5=Moderate; 7=Severe.

AVAILABLE

Table 23

Four characteristics for *Spartina patens* growing on a tidal bank, 1981 1/

Accession/ Replication	Culms 2/	Uniform Stand	Erosion Control 3/	Seedheads 4/
PI-421237				
I	316	No 5/	2 6/	10 6/
II	220	Yes	2	9
Ave.	268			
PI-421238				
I	145	Yes	1	6
II	210	No	1	5
Ave.	178			
PI-421239				
I	135	No	2	10
II	150	Yes	2	10
Ave.	142			
PI-421250				
I	94	Yes	2	10
II	130	No	4	9
Ave.	112			
PI-421262				
I	125	No	3	10
II	105	Yes	2	7
Ave.	115			
PI-434390				
I	165	Yes	1	7
II	230	Yes	2	9
Ave.	198			

1/ Planting established May 4, 1980 at Nags Head, NC; data recorded September 16.

2/Number of culms growing in an area 30 cm x 30 cm - selected to represent average density.

3/Effectiveness of accession to control erosion within planted area.

4/Seedhead production without regard to stage of maturity or actual seed yield.

5/Ratings are: No=Stand of plants not uniformily distributed over plot; Yes=Plant density generally uniform.

6/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Table 24

Relative rating for six *Spartina patens* accessions, 1981[1/]

	R-I	R-II
Best	PI-434390	PI-434390
2nd Best	PI-421238	PI-421237
3rd Best	PI-421239	PI-421239

1/Planting established at Nags Head, North Carolina on May 4, 1980; data recorded September 16.

2/Best accession selected on visual observation for vigor, cover, amount of growth and intended purpose.

Table 25

Stand and vigor for six accessions of *Spartina patens* on the edge of a marsh, 1981[1]

PI No./ Replication	Stand[3]	Vigor[3]	Best[2]
421237			
I	4	2	X
II	7	6	X
III	5	3	X
421238			
I	9	7	
II	9	8	
III	8	4	
421239			
I	9	7	
II	8	8	
III	8	6	
421250			
I	8	5	
II	9	8	
III	8	8	
421262			
I	7	5	
II	8	6	
III	6	3	
434390			
I	7	8	
II	9	8	
III	8	7	

---

[1] 100 hills established/accession/replication on May 20, 1980 near Wareham, MA; Ratings recorded June 20.

[2] Best accession in replication.

[3] Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 26

Spread, cover and vigor for six accessions of *Spartina patens* on the edge of a marsh, 1981[1]

PI No./ Replication	Spread[2] (cm)	Cover[4]	Vigor[4]	Best[3]
421237				
I	23/20	4	4	1st
II	13/20	8	4	1st
III	28/18	5	5	2nd
421238				
I	-/-[5]	10	-	
II	-/-	10	-	
III	13/13	9	6	3rd
421239				
I	-/-	10	-	
II	-/-	10	-	
III	-/-	10	-	
421250				
I	18/28	8	4	3rd
II	-/-	10	-	
III	8/4	9	7	3rd
421262				
I	23/10	8	5	2nd
II	13/8	9	6	2nd
III	19/25	5	4	1st
434390				
I	-/-	10	-	
II	-/-	10	-	
III	-/-	10	-	

---

[1] 108 hills established/accession/replication on May 28, 1980 near Wareham, MA; Ratings recorded October 5.

[2] Average spread in centimeters for two hills in each plot.

[3] Best accessions in replication.

[4] Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

[5] - = Dead or missing.

Table 27

Relative rating of the three best accessions of *Spartina patens* on a tidal bank, 1981[1]

	R-I	R-II	R-III
Best[2]	PI-421237	PI-421238	PI-421238
2nd best	PI-421250	PI-421237	PI-421262
3rd best	PI-421262	PI-421239	PI-421237

Table 28

Stand for five *Spartina patens* accessions on a sand dune, 1981[1]

PI No.	Replication		
	I	II	III
421237	3[3]	3	4
421238	2	2	3
421239	5	3	6
421250	3	4	5
421262	3	3	4

---

[1] Planting installed May 3, 1979 at Pickering Beach, Delaware; data recorded August 24.

[2] Ratings based on amount of growth, vigor, ground cover and ability to grow through accumulated sand.

[3] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 29

Relative ratings for five accessions [1] of *Spartina patens* on a tidal bank, 1981

	R-I	R-II	R-III
Best [2]	PI-421262	PI-421237	PI-421239
2nd best	PI-421238	PI-421238	PI-421237
3rd best	PI-421237	PI-421250	PI-421262
4th best	PI-421239	PI-421262	PI-421250
Last	PI-421250	PI-421239	PI-421238

---

[1] Planting installed May 1978 at Trappe, Maryland; data recorded September 1.

[2] Ratings based on amount of growth, spread, vigor and sand cover to include cover if the vegetation was laid down in a "shingle affect".

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FINAL REPORT

Tidal Streambank Site Selection Technique for Stabilization with Vegetation

34CO10F

The SCS has been conducting plantings on tidal streambanks in the state of Virginia for the past 20 years. The Cape May PMC Staff has assisted with installation and evaluation of tidal plantings in the Northern Neck area since 1972. The original objective was to select adapted species and proper planting techniques to stabilize the streambanks along tidal waters.

The initial work by the PMC Staff was made in close cooperation with the PMS responsible for Virginia and future projects involved the PM Team. *Spartina alterniflora* (smooth cordgrass), *S. patens* (saltmeadow cordgrass) and 'Cape' *Ammophila breviligulata* (American beachgrass) were selected as the logical species for streambank stabilization.

Basically, the planting procedure involves vegetating the inter-tidal zone to absorb some of the wave action as the force hits the beach and establishing plants above this zone to stop or reduce the rate of bank erosion and even to trap sand during storms. *S. alterniflora* is planted in the inter-tidal zone. A few rows of *S. patens* are established above and parallel to the high tide elevation. Cape is used to stabilize the beach since this species can tolerate sand deposition but will not grow in the water.

Some criteria is necessary to determine the practicality of stabilizing a particular site with vegetation and the probability of success in the absence of a severe storm during the first year. The PM Team, assisted by the National PMC Staff, has recognized several variables that appear to affect the success in vegetating tidal streambanks. They are 1)off-shore gradient, 2)potential width of planting area, 3)absence of shade, 4)fetch, 5) depth of sand on beach at mean high water, 6)width of beach above mean high water, 7)presence of beach vegetation, 8)shape of shore line and 9)shoreline orientation. These variables were used by SCS to develop a criteria worksheet that has been field tested at numerous sites.

During the latter part of 1980, the Virginia Soil and Water Conservation Commission and the Soil Conservation Service entered into an agreement to conduct a vegetative research project. This project was designed to accelerate and further the study for site selection and to determine inexpensive methods to stabilize the toeline of eroding tidal estuaries of the mid-Atlantic coast.

The SCS is providing plant materials and technical assistance on plant materials which are necessary to carry out this study. A substantial portion of the cost for these services and materials are funded by Virginia State Legislature.

The Shore Erosion Advisory Service of the Virginia Soil and Water Commission is directly responsible for the project, therefore, this will be the final report concerning tidal streambank site selection from the Cape May PMC.

AVAILABLE

TABLE 1 VEGETATIVE TREATMENT POTENTIAL FOR ERODING TIDAL BANKS IN THE MID-ATLANTIC STATES

DIRECTIONS FOR USE

1. Evaluate each of the first four shoreline variables and match the site characteristics of the variable to the appropriate descriptive category.
2. Place the Vegetative Treatment Potential (VTP) assigned for each of the 4 variables in the right hand column.
3. Obtain the Cumulative Vegetative Treatment Potential for variables 1, 2, 3, & 4, by adding the VTP for each.
4. If it is 23 or more, the potential for the site to be stabilized with vegetation is very good and the rest of the table need not be used. If it is below 23, go to step 5.
5. Determine the VTP for shoreline variables 5 through 9 and obtain the cumulative VTP for variables 1-9.
6. Compare the cumulative VTP score with the Vegetative Treatment Potential Scale at the bottom of this page.

SHORELINE VARIABLES	DESCRIPTIVE CATEGORIES The Vegetative Treatment Potential (VTP) Is Located in Upper Left Hand Corner of Each Category Box					VTP for Each Variable
1 Fetch: Average distance in miles of open water measured perpendicular to the shore and 45° either side of perpendicular to shore	8 Less than 0.5 miles	7 0.5 thru 1.4 miles	4 1.5 thru 3.4 miles	2 3.5 thru 4.9 miles	0 over 5 miles see footnote 1/	
2 General shape of shoreline for distance of 200 yards on each side of planting site.	8 Coves	3 Irregular shoreline	0 Headland or straight shoreline			
3 Shoreline Orientation: General geographic direction the shoreline faces	5 Any orientation less than one-half mile fetch.	3 West to North	2 South to West	1 South to East	0 North to East	
4 Boat Traffic: Proximity of site to recreational & commercial Boat traffic	5 None	3 1-10 per week within 1/2 mi. of shore	2 More than 10 per week within 1/2 mile of shore	1 1-10 per week within 100 yards of shore	0 More than 10 per week within 100 yds. of shore	

Cumulative Vegetative Treatment Potential for variables 1, 2, 3, & 4 ______

If this score is 23 or above, the potential for the site is very good and the rest of the table need not be used.
If it is below 23, go to step 5 below

5 Width of Beach Above Mean High Tide in Feet	3 Greater than 10'	2 10' thru 7'	1 6' thru 3'	0 Less than 3'	
6 Potential Width 2/ of Planting Area in Feet	3 More than 20'	2 20' thru 15'	1 14' thru 10'	Less than 10' Do Not Plant	
7 On Shore Gradient % slope from MLW to toe of bank	6 Below 8%	3 8 thru 14%	1 15 thru 20%	0 over 20%	
8 Beach Vegetation	3 Vegetation below toe of slope	0 No vegetation below toe of slope			
9 Depth of Sand 3/ at Mean High Tide in inches	3 More than 10"	2 10" thru 3"	0 Less than 3"		

Cumulative Vegetative Treatment Potential for Variables 1-9 ______

1/ Do not plant or see page 9 and figure 9 for possible exception.

2/ If tidal fluctuation is 2.5 feet or less, measure from MLW to toe of bank. If tidal fluctuation is over 2.5 feet, measure from MW to toe of bank. See page 7 for more information.

3/ Refers to depth of sand deposited by littoral drift over the substrata.

VEGETATIVE TREATMENT POTENTIAL SCALE

If the VTP is between	and	Potential of Site to be Stabilized with Vegetation
40	33	Good
32	24	Fair
23	16	Poor
below 16		Do Not Plant

Cordgrass Planting Technique

34C022F

Several procedures have been used for the establishment of successful cordgrass on tidal streambanks. Fertilizer is essential when planting in a sterile sand and is desirable even on clay sites. Controlled release and soluble fertilizers applied at the time of establishment produced conflicting results when compared with each other for effectiveness. Despite the cost, the controlled release material (3-4 months) is the preferred fertilizer especially when planting below the high water elevation. The cordgrasses will not tolerate shade. The best management techniques will not overcome the problem of a shady site. Unless the shade can be eliminated, establishment efforts are worthless. *Spartina alterniflora* (smooth cordgrass) plants that are not grown in a saline medium, must be acclimated to salt well in advance to planting into the tidal zone.

An elaborate planting was established by the Cape May PMC staff in Richmond County, Virginia in May 1979. The site had several desirable characteristics which were favorable for success. The off-shore gradient was flat, it was exposed to full sun, the beach was sandy and the shoreline orientation was partially protected from the storms.

The planting included 3,000 plants of 'Cape' *Ammophila breviligulata* (American beachgrass), 3,000 *S. patens* (saltmeadow cordgrass) plants and 2,000 potted and 2,000 field grown *S. alterniflora* plants. All plots were fertilized with a controlled release fertilizer at the rate of 1100 kg/ha. A severe summer storm destroyed nearly the entire planting. It was considered a failure in October despite the few surviving plants. These storms usually occur several years apart, but have the potential to inflict severe damage within their path of travel. A tidal bank planting, like any other vegetative practice, is subjected to damage before the plants are well established, therefore, some risk is involved.

In May of 1980, another planting was made on this site using the same species and design. Cape was established as bare-root plants while *S. alterniflora* and *S. patens* were established as both potted and bare-root plants. Each type of plant was fertilized with osmocote and a readily soluble fertilizer. Thirty grams of 19-6-12 osmocote and 35 grams of grandular 10-10-10 per hill were used in each respective subplot. Two rows of Cape, 3 rows of *S. patens* and 5 rows of *S. alterniflora* were established in each of the 2 plots. Rows were spaced 60cm apart with 80 plants per row. Plants were spaced 45cm apart within the row and staggered with the adjacent row.

Initially, there was severe bank sloughing which resulted in the loss of some plants. This condition later stabilized and was not a problem. All three species were well established by mid-August, along with some native vegetation which volunteered on the steep slope. The S. alterniflora plants which were planted in the 30 meter downstream section and part of two other nearby rows were washed away by tidal action.

By mid summer of 1981, only one replication was considered effective for erosion control. Some S. alterniflora plants were lost but A. breviligulata and S. patens appeared to be well established. There is no significant difference in performance between bare-root and potted plants, however, the use of osmocote is much more desirable than soluble fertilizer. Erosion control is rated good to excellent for this replication.

A third planting was made at this location in 1981. This planting failed to become established. Consequently, little information was obtained. It is believed that this site has too much fetch and the beach is too narrow for successful establishment of vegetation without mechanical breakwater structures.

Table 1

Characteristics of three species for planting technique on a tidal bank, 1981[1]

Replication/ treatment/ species	Stand	Vigor	Cover	Protection[2]
R-I				
10-10-10				
Potted				
'Cape'	10[3]			
Saltmeadow cordgrass	10			
Smooth cordgrass	10			
				10
Bare-root				
Cape	10			
Saltmeadow cordgrass	10			
Smooth cordgrass	10			
				10
Osmocote				
Potted				
Cape	9[4]	7	9	
Saltmeadow cordgrass	3(.3)	3	9	
Smooth cordgrass	5(.1)	5	8	
				4
Bare-root				
Cape	8	7	9	
Saltmeadow cordgrass	3(.5)	2	2	
Smooth cordgrass	2(.2)	4	1	
				5
R-II				
10-10-10				
Potted				
Cape	5	3	5	
Saltmeadow cordgrass	3	2	2	
Smooth cordgrass	4(.5)	5	6	
				3
Bare-root				
Cape	3	2	3	
Saltmeadow cordgrass	4	2	2	
Smooth cordgrass	3(.5)	2	2	
				2
Osmocote				
Potted				
Cape	3	2	4	
Saltmeadow Cordgrass	2	2	2	
Smooth cordgrass	3	3	2	
				2
Bare-root				
Cape	2	1	2	
Saltmeadow cordgrass	2	1	1	
Smooth cordgrass	2(.8	2	2	
				1

1/Plants established March 26 and May 21, 1980; data recorded April 29.

2/Rating is based on beach and toe of bank protection for all three species.

3/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

4/The fraction in represents that portion of the planted area now vegetated.

Table 2

Stand for three species planted on a tidal bank, 1981[1]

Treatment	'Cape'	Spartina patens	S. alterniflora
Osmocote			
Potted			
R-I	10[2]	3	10
R-II	3	3	5
Bare-root			
R-I	10	3	10
R-II	2	2	2
10-10-10			
Potted			
R-I	10	10	10
R-II	5	3	10
Bare-root			
R-I	10	10	10
R-II	3	2	3

---

[1] Planting installed May 1980; data recorded August 27.

[2] Rating: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

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Table 3

EVALUATION OF CORDGRASS PLANTING TECHNIQUE - 1981 1/ VIRGINIA

REPLICATION/ TREATMENT	SMOOTH CORDGRASS	SALTMEADOW CORDGRASS	AMERICAN BEACHGRASS
REPLICATION I			
10-10-10, potted	None	None	None
Osmocote, potted	None	Solid 90 ft^2 block, all above high tide. Dormancy 33%. 8 - 12" trapped sand.	None
10-10-10, bare root	None	None	Four plants.
Osmocote, bare root	None	Solid 20 ft^2 block, all above high tide. Dormancy 40%. 12" trapped sand.	Two plants.
REPLICATION II			
10-10-10, potted	None	25' of 30' solid block 1' to 4' wide and spreading. 75% dormant.	25' of 30' solid block width solid to cliff.
Osmocote, potted	Solid block, 3' high on average. Sand eroding.	Solid block. Eight inches of sand trapped.	Solid block.
10-10-10, bare root	Solid block, all 4' high. Resisting erosion.	Solid block, vigor variable.	Solid block.
Osmocote, bare root	Solid block, all 2' - 4' high.	Solid block.	Solid block.

1/Planting established May 21, 1980 at Melvin Moss Property; data recorded October 30.

Table 4

Stand for three species growing on a tidal bank, 1981[1/]

Treatment	'Cape'	*Spartina patens*	*S. alterniflora*
Osmocote			
Potted			
R-I	10[2/]	10	10
R-II	10	7	9
Bare-root			
R-I	10	5	10
R-II			
10-10-10			
Potted			
R-I	10	7	10
R-II	10	10	10
Bare-root			
R-I	10	10	10
R-II	10	10	10

[1/] Planting installed May 20 near Famham, Virginia; data recorded August 27.

[2/] Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Virginia Erosion Control Project

34A019F

In 1980, the Virginia State Legislature appropriated funds for the acceleration of tidal streambank stabilization by vegetative means. The Virginia Soil and Water Conservation Commission, the Virginia Institute of Marine Science (VIMS) and the Cape May PMC are the cooperators in this joint project. The Shore Erosion Advisory Service (SEAS), a division of the Commission, administers the project.

The objectives of the project are to (1) determine a criterion for selecting sites where planted vegetation can be expected to be successful because of favorable beach characteristics and (2) to perfect the planting technique for *Spartina patens* (saltmeadow cordgrass) and *S. alterniflora* (smooth cordgrass) on tidal streambanks.

The project was written for five years duration. This time frame would permit plant selection and production, two years of planting on various sites and the final evaluation of plant materials for shore line stabilization. Funding for the project was approved for only two years.

The Cape May PMC obligation is to produce plants for the tidal sites. Due to limited facilities, the National PMC is assisting with the production and delivery. In addition, the PM staff and Virginia SCS staff assisted with some of the planting and evaluations. The first plantings were established in 1981 on 12 sites.

These planting sites were evaluated on October 28, 1981. Evaluations were made by Plant Material personnel.

	Survival	Vigor
Camp Chanco:		
Smooth cordgrass	60-70%	Good
Saltmeadow cordgrass	80-85	Good
F. N. Lee:		
Smooth cordgrass	75	Excellent
Saltmeadow cordgrass	60	Good
Hickman:		
Smooth cordgrass	65-75	Good
Saltmeadow cordgrass	10	Poor
Tankard:		
Smooth cordgrass	0	-
Saltmeadow cordgrass	0	-
Carter Wellford:		
Smooth cordgrass	55	Excellent
Saltmeadow cordgrass	Not planted	
Durham-South:		
Smooth cordgrass	25	Fair
Saltmeadow cordgrass	50	Fair
Durham-West:		
Smooth cordgrass	40	Good
Saltmeadow cordgrass	10	Fair

VEGETATIVE EROSION CONTROL PROJECT

First Year

Post Planting - Outlined Progress Report

by

C. Scott Hardaway
Virginia Institute of Marine Science

The Vegetative Erosion Control (VEC) Project of fiscal year 1980-81 has completed its initial monitoring of 12 planted sites in the Commonwealth. This report reflects data acquisition of various factors involved in the VEC planting project. Detailed analysis of this data and discussion will occur in a report following the first full growing season. The data is given in outline form for each planting site.

Table 1 is a synthesis of each site and important variables which affect the marsh grass plantings. The data is based on field work conducted by the Virginia Institute of Marine Science's (VIMS) VEC team before, during and subsequent to each planting. Monitoring of each site will be an ongoing procedure.

TABLE 1.

PLANTING SITES FOR VEGETATIVE EROSION CONTROL PROJECT - 1981

SITES VARIABLES	1. Mountjoy	2. Camp Chanco	3. Windmill Point	4. Lee	5. Gill	6. Hickman	7. Tankard	8. Wellford	9. Durham South	10. Durham West	11. Garret	12. Murphy
EROSION RATE (ft./yr.)	2.2	1.1	4.2	.95	3.8	2.6	7.0	.95	2.0	1.8	1.7	.4
AVERAGE FETCH (nautical Miles)	15.6	3.1	13.4	.69	15.0	7.5	22.0	2.3	1.5	1.6	4.5	.85
SHORE FACES	S	NE	S	NNE	NNE	NW	WNW	SW	SSW	W	NE	N
WAVE ENERGY	Hi	Med	Hi	Lo	Hi	Med	Hi	Med	Med	Med	Med	Lo
6 FOOT CONTOUR (from MLW)	1800	600	1700	200	1700	800	1400	3600	3200	3800	2000	200
INTERTIDAL SLOPE:												
MHW → MLW	1:77	1:13	1:6	1:10	1:8	1:35	1:14	1:11	1:9	1:11	1:9	1:12
MHW → MTL	1:7	1:8	1:6	1:10	1:8	1:24	1:9	1:10	1:7	1:5	1:9	1:11
BANK ELEVATION (ft.)	3-4	46	2-3	10-18	9-12	3	12-14	23	5	8	15	23-3
BEACH SEDIMENTS:												
% sand/gravel	84	86/9	95/2	93/4	80/14	60		98/2	97	100		82/8
% silt	10	1	1	1	1	1		-	-	-		-
% clay	6	4	2	2	5	9		-	3	-		-
NEARSHORE SEDIMENTS												
% sand/gravel	95	92	86/7	95/1	82/4	94		88/4	90	51/49		97/2
% silt	2	1	2	1	5	4		5	2	-		-
% clay	3	7	5	3	9	2		3	8	-		-
NET DRIFT, to the	E	SE	W	SE	SE	SW	SW	SE	SE	S	SE	E
MEAN TIDE RANGE (ft.)	2.4	1.9	1.2	1.3	1.3	1.7	2.4	1.8	1.8	1.8	1.8	1.3
SALINITY (ppt.)	14-19	0-6	14-16	8-15	-	18-22	19-23	2-7	5-11	5-11	5-11	-
INITIAL NO. OF PLANTS:												
Smooth Cordgrass	2060	660	670	660	1840	1475	1475	1340	1340	1340	480	660
Saltmeadow Hay	-	200	400	460	2196	550	2200	-	400	270	270	150
MORTALITY: (% loss)												
Smooth Cordgrass - washout	50	37	66	21	100	19	87	40	65	63	99	6
Total	99	37	90	55	100	20	100	40	85	63	99	90
Saltmeadow Hay - washout	-	18	58	40	100	28	16		35	90	95	20
Total	-	18	58	40	100	28	16		35	90	95	50

2. CAMP CHANCO - JAMES RIVER, SURRY COUNTY

I Reach Analysis

A. Site Location

1. Surry, Virginia - Topographic Quadrangle.
2. NE facing shore between Scotland Landing and Crouch Creek at coordinates 37°10'48" north and 76°27'00".

B. Historic Erosion

1. 1.1 feet/year.
2. Reach - from Crouch Creek northward ~2,700 feet to Scotland Landing.

C. Study Site

1. Aerial targets - 80 feet apart.
2. Five profiles - average length 200 feet from profile pipes.
3. Base map - shore length ~220 feet.

D. Wave Energy Evaluation

1. Shore orientation - strikes ~N 17°W (343°) from geographic north.
2. Average fetch - 3.1 nautical miles.
3. Medium energy shore.
4. Winds most affecting shore: N, NE and E.
5. Distance to 6 foot contour from MHW = 600 feet.
6. Ferry channel at Scotland Landing major ship channel 5,000 feet offshore.

E. Littoral System

1. Tide range: mean = 1.9 feet
   spring = 2.1 feet
   (Scotland)
2. Net sediment drift : to the SE.
3. Shore type: bluff.

    - a. Elevation: 45-48 feet above MTL.
    - b. Composition: Variable mixtures of gravel, sand and clay rich strata and a highly fossiliferous shell zone (1-3 thick) which breaks off into boulders and accumulates along the base of the bluff.
    - c. Bank face is mostly vertically exposed and actively eroding. Cudzoo is abundant along the lower part of the bluff.

4. Sediments of Beach and Nearshore
    - a. Source: mostly from bank erosion within reach.
    - b. Beach: rather clean medium to very coarse sand, gravel and fossil shell material.
    - c. Nearshore: coarser sand, gravel and shell mixed with fine sand and silt becoming fine sands and sills offshore.

5. Profiles - January 27, 1981 and May 20, 1981
    - a. MHW → MLW - 25 feet (1:13)
    - b. MHW → MTL - 7 feet (1:8)
    - c. Net change: loss of 1-3 inches across beach face.

II MARSH PLANTING EVALUATION

A. Planting Environment

1. Salinity - 1-6 ppt.
2. Planting substrate - gravel, rock and shell 5-8 inches thick over clayey sand.
3. Northern exposure - moderate sunlight.

B. Planting Procedure

1. Plants - delivered to White Marsh on May 26th.
    - a. Smooth Cordgrass (Spartina alterniflora) 660 peat pots.
    - b. Saltmeadow Hay (Spartina patens) 200 peat pots.
2. Planting Team - May 26th
    - a. S.C.S. - Tim Garrahan, John Marille.
    - b. VSWCC - George Sweeten, Bernie Harrchin.

c. SEAS - Lee Hill

3. Row Pattern

a. Smooth cordgrass
9 rows X 110 feet

b. Saltmeadow Hay
3 rows X 90 feet

C. Mortality

1. Initial - 15-25% loss overall.

2. To date (8-1-81).

a. Smooth cordgrass - 30-40%.

b. Saltmeadow Hay - 15-20%.

3. Remarks - remaining plants are green and healthy.

4. F.N. LEE - WEST BRANCH OF CORROTOMAN RIVER - LANCASTER COUNTY

I Reach Analysis

A. Site Location

1. Irvington, Virginia, Topographic Quadrangle

2. South shore, just south of Merry Point Ferry at coordinates 37°41'53" north, 76°28'25" west. Shore faces NNE.

B. Historic Erosion - 1. .95 feet/year measured over 87 years.
2. Reach - from Merry Point Ferry to headland east of site.

C. Study Site

1. Aerial targets - 100 feet apart.

2. Four profiles - average length 150 feet from profile pipes.

3. Base map - shore length = ~320 feet.

D. Wave Energy Evaluation

1. Shore orientation - strikes ~N 73° W (287°) from geographic north.

2. Average fetch = .69 nautical miles.

3. Low energy shore (< 1 nautical mile).

4. Winds most affecting shore: NW, N and NE.

5. Distanct to 6 foot contour from MHW = 200 feet.

6. No channel near site.

E. Littoral System

1. Tide range: mean = 1.3 feet
spring = 1.6 feet
(Bowlers Rock)

2. Net sediment drift: to the SE.

3. Shore type: high and low sediment bank.

   a. Elevation: 18 feet grading SE to 3 feet above MTL.

   b. Composition: mostly buff to greyish slightly clayey fine to coarse sand and gravel.

    c. Bank face relatively stable due to abundance of upland vegetation. Basal 2 feet is exposed by wave action and void of vegetation.

4. Sediments of beach and nearshore

    a. Source: mostly from bank erosion within reach.

    b. Beach: clean medium-coarse sand and gravel. Forty feet wide and variable.

    c. Nearshore: fine sands and silt.

5. Profiles - February 2, 1981 and April 29, 1981

    a. MHW → MLW - 15 feet (1:10).

    b. MHW → MTL - 5.5 feet (1:10).

    c. Net change: 4-6 inches loss off beach face.

II MARSH PLANTING EVALUATION

A. Planting Environment

1. Salinity - 8-15 ppt.

2. Planting substrate - beach sands 4-6 inches thick with underlying clayey sand.

3. Northern Exposure - limited sunlight.

B. Planting Procedure

1. Plants - delivered to Warsaw, Virginia on May 4th

    a. Smooth Cordgrass (*Spartina alterniflora*) - 660 peat pots.

    b. Saltmeadow Hay (*Spartina patens*) - 460 peat pots.

2. Planting Team - May 6th

    a. S.C.S. - Ben Hedley, Blaine Delaney.

    b. SEAS: Nancy Ibison.

    c. VIMS: Tom Barnard, George Thomas.

3. Row Pattern

    a. Smooth cordgrass
    9 1/3 rows X 150 feet
    planted at and below MHW

b. Saltmeadow Hay
7 to 8 rows X 150 feet
planted above MHW

C. Mortality

1. Initial - 5-10% less overall

2. To date (8-1-81).

    a. Smooth cordgrass - 20-25% loss.

    b. Saltmeadow Hay - 30-40% loss.

3. Remarks: remaining plants are green and healthy.

6. HICKMAN - OCCAHANNOCK CREEK, NORTHAMPTON COUNTY

I Reach Analysis

A. Site Location

1. Jamesville, Virginia - Topographic Quadrangle.
2. At mouth of Occahannock Creek, south shore at coordinates 37°32'55" north and 75°56'05" shore faces NW.

B. Historic Erosion

1. 2.6 feet/year over 90 years.
2. Reach - marsh headland 1,200 feet to NE southwestward to marsh grown spit 600 feet to SW.

C. Study Site

1. Aerial targets - 200 feet apart.
2. Five profiles - average length 250 feet from profile pipes.
3. Base map - shore length = ~ 330 feet.

D. Wave Energy Evaluation

1. Shore orientation - strikes ~ N 40° E (40°) from geographic north.
2. Average fetch - 7.5 nautical miles.
3. Medium energy shore.
4. Winds most affecting shore: NW, W and SW.
5. Distance to 6 foot contour from MHW = 800 feet.
6. Minor channel through creek 900 feet offshore.

E. Littoral System

1. Tide range: mean = 1.7 feet
   spring = 20 feet
2. Net sediment drift: to the SW.
3. Shore type: low sediment bank.
   a. Elevation: 3 feet above MTL.
   b. Composition: light brown and grey clayey fine-medium sand.

c. Bank face vertically exposed and void of stabilizing vegetation.

4. Sediments of Beach and Nearshore

a. Source: mostly from bank erosion within reach.

b. Beach: clean fine-medium sand.

c. Nearshore: fine sands and silt.

5. Profiles - January 28, 1981 and May 28, 1981

a. MHW → MLW - ~ 60 feet (1:35).

b. MHW → MTL - ~ 20 feet (1:24).

c. Net change: little or no change.

II MARSH PLANTING EVALUATION

A. Planting Environment

1. Salinity - 18-22 ppt.

2. Planting substrate - mostly clayey sand under thin veneer of sand.

3. Western exposure - adequate sunlight.

B. Planting Procedure

1. Plants - delivered to Accomac on May 28th.

a. Smooth Cordgrass (Spartina alterniflora) - 1,475 peat pots.

b. Saltmeadow Hay (Spartina patens) - 550 peat pots.

2. Planting Team - May 29th

a. S.C.S. - Glenn Anderson, Ron Godwin.

b. VIMS - George Thomas, Beth Lester, Drew Zacherle, Scott Hardaway.

3. Row Pattern

a. Smooth cordgrass
11 rows X 200 feet
planted at and below MHW

b. Saltmeadow Hay
4 rows X 200 feet
planted above MHW

C. Mortality

1. Initial - 10-15% loss overall.

2. To date (8-1-81).

    a. Smooth cordgrass - 20-30% loss.

    b. Saltmeadow Hay - 30-40% loss.

3. Remarks: Some loss from washout but mostly plant death. Remaining plants are green and healthy.

7. TANKARD - CHESAPEAKE BAY - NORTHAMPTON COUNTY

I Reach Analysis

A. Site Location

1. Cape Charles, Virginia - Topographic Quadrangle.

2. West facting shore ~½ mile south of Smith's Beach at coordinates 37°20'40" north, 76°00'15" west.

B. Historic Erosion

1. 7.0 feet/year.

2. Reach - from point where old cottage used southward to wooden shore below site.

C. Study Site

1. Aerial targets - 200 feet apart.

2. Five profiles - average length ~ 170 feet from bank profile pipes.

3. Base map - shore length ~ 690 feet.

D. Wave Energy Evaluation

1. Shore orientation - strikes N 33°E (33°) from geographic north.

2. Average fetch - 22.0 nautical miles.

3. High energy shore

4. Winds most affecting shore: N, NW, W and SW.

5. Distance to 6 foot contour from MHW = 1,400 feet.

6. No channel near site, Baltimore Channel 4 miles offshore.

E. Littoral System

1. Tide range: mean = 2.4 feet
   spring = 2.9 feet
   (Cape Charles)

2. Net sediment drift: to the SW.

3. Shore type: high sediment bank.

        a. Elevation: 12-14 feet above MTL.

        b. Composition: mostly buff to tan slightly clayey fine-coarse sand and occasional gravel.

        c. Bank face is vertically exposed, with numerous slump blocks and void of stabilizing vegetation.

    4. Sediments of Beach and Nearshore

        a. Source: mostly from erosion of adjacent banks within and beyond defined reach.

        b. Beach: clean medium-coarse sand and gravel 50-60 feet wide from toe of bank.

        c. Nearshore: fine-medium sand.

    5. Profiles - February 10, 1981 and May 28, 1981

        a. MHW → MLW - 34 feet (1:14).

        b. MHW → MLW - 11 feet (1:9).

        c. Net change: 4-8 inches loss off beach face, consequent gain on backshore.

II MARSH PLANTING EVALUATION

A. Planting Environment

    1. Salinity - 19-23 ppt.

    2. Planting substrate - beach sand 8-12 inches thick.

    3. Western Exposure: no bank top vegetation sufficient sunlight.

B. Planting Procedure

    1. Plants - delivered to Accomac on May 28th.

        a. Smooth Cordgrass (*Spartina alterniflora*) - 1,475 peat pots.

        b. Saltmeadow Hay (*Spartina patens*) - 2,200 peat pots.

    2. Planting Team: May 29th

        a. S.C.S. - Louis Cullipher, Tom Heisler, Walter Hamilton, Earl Williamson, David Ackiss, Bill Lincoln.

        b. VSWCC - George, Rennie Houchins.

        c. SEAS - Lee Hill, Nancy Ibison, Jack Frye.

3. Row Pattern

    a. Smooth Cordgrass
    10 rows X 200 feet
    planted 4 rows above MHW and out (bayward)

    b. Saltmeadow Hay
    6 to 13 rows X 420 feet
    planted from cordgrass to bank

C. Mortality

1. Initial - 30-40% loss overall.

2. To date (8-1-81).

    a. Smooth Cordgrass - 100% loss.

    b. Saltmeadow Hay - 15-20% loss

3. Remarks: Smooth cordgrass mostly washed out. Remaining Saltmeadow Hay is green and healthy.

8. CARTER WELLFORD - RAPPAHANNOCK RIVER, RICHMOND COUNTY

I REACH ANALYSIS

A. Site Location

1. Tappahannock, Virginia - Topographic Quadrangle.
2. North shore at coordinates 37°55'05" north and 76°45'25" west.

B. Historic Erosion

1. .95 feet/year measured over 87 years.
2. Reach defined from Little Carter Creek to Jugs Creek.

C. Study Site

1. Aerial targets - 200 feet apart.
2. Five profiles - average length 180 feet from profile pipes.
3. Base map length = ~390 feet.

D. Wave Energy Evaluation

1. Shore orientation - strikes N 50° W (310°) from geographic north.
2. Average fetch = 2.33 nautical miles.
3. Medium energy.
4. Winds most affecting shore: W, SW and S. NW from refraction.
5. Distance to 6 feet contour from MHW = 3,600 feet.
6. No channel near site.

E. Littoral system

1. Tide range: mean = 1.75 feet
   spring = 2.0 feet
   (midway between Tappahannock and Bowlers Rock)
2. Net drift: to the SE.
3. Shore type: High sediment bank.
   a. Elevation: 22-23 feet above MTL.

b. Composition: Basal 2-3 feet consists of Blue-Grey very fine sandy clay with numerous fossil shell molds and casts. Overlain by sandy unit, a highly bedded rather clean fine to very coarse sand and gravel with occasional cobbles.

c. Bank face mostly unstable with scant vegetation across sandy unit. Basal clay is totally void of vegetation and holds steeper grade than sandy unit.

4. Sediments of Beach and Nearshore

   a. Source: mostly from erosion of adjacent bank and those upstream.

   b. Beach: composed of clean medium-very coarse sand and gravel (some cobbles). Forty feet wide and continuous. Eight to twelve inches thick over blue-grey clay unit.

   c. Nearshore: fine sands and silts.

5. Profiles - March 2, 1981 and April 22, 1981

   a. MHW - MLW = 19.5 feet (1:11).

   b. MHW - MTL = 9 feet (1:10).

   c. Net change: 6 inches of sand from upper beach to lower beach face.

II MARSH PLANTING EVALUATION

A. Planting Environment

1. Salinity - 2-7 ppt.

2. Planting substrate - 8-12 inches of beach sand over blue-grey sandy clay.

3. Southern exposure - abundant sunlight.

B. Planting Procedure

1. Plants

   a. Smooth cordgrass (Spartina alterniflora)
   1,340 no peat pots

   b. No saltmeadow

2. Planting Team - May 5th

   a. S.C.S.: Ken Carter, Ed Scates, Blaine Delaney, Cluster Belcher.

b. SEAS: Jack Frye.

c. VIMS: Walter Priest, George Thomas.

3. Row Pattern

a. Smooth Cordgrass
10 rows X 200 feet planted at and below MHW

C. Mortality

1. Initial - 5-10% loss overall.

2. To date (8-1-81).

a. Smooth cordgrass - 30-45%.

3. Remarks - plants green and healthy.

12. MURPHY - PIANKATANK RIVER, MIDDLESEX COUNTY

I REACH ANALYSIS

A. Site Location

1. Wilton, Virginia - Topographic Quadrangle.
2. 2,500 feet each of Cobbs Creek at coordinates $37^{\circ}31'38''$ north, $76^{\circ}23'35''$ west. Shore faces north.

B. Historic Erosion

1. < .5 feet/year.
2. Reach from mouth of Cobbs Creek eastward to Pond Point.

C. Study Site

1. Aerial Targets - 102 feet apart.
2. Five profiles 170-190 feet from profile pipes.
3. Base map - shore length ~ 345 feet.

D. Wave Energy Evaluation

1. Shore orientation - strikes east-west (90°) from geographic north.
2. Average fetch - 8.4 nautical miles.
3. Low Energy Shore.
4. Winds most affecting shore: NW, N and NE.
5. Distance to 6 foot contour from MHW = 200 feet.
6. No major channel new site.

E. Littoral System

1. Tide range: mean = 1.3 feet
   spring = 1.6 feet
   (Dixie)
2. Net sediment drift: to the east.
3. Shore Type: high sediment bank.
   a. Elevation: 23 feet grading eastward to 3 feet above MTL.

    - b. Composition: tan to grey and buff slight clayey fine-coarse sand and gravel which includes fossiliferous zone.
    - c. Bank face vertically exposed with placed tree trunks running vertically along shore.
- 4. Sediments of beach and nearshore
    - a. Source: mostly from bank erosion within reach.
    - b. Beach: clean fine-coarse sand and gravel with fossil shell frags.
    - c. Nearshore: mostly very fine to fine sand and silt.
- 5. Profiles - March 10, 1981 and May 13, 1981
    - a. MHW → MLW - 15.5 feet (1:12).
    - b. MHW → MTL - 8 feet (1:11).
    - c. Net change: 2-5 inches loss from upper beach face and subsequent gain on lower beach face.

II MARSH PLANTING EVALUATION

A. Planting Environment

1. Salinity - unknown.
2. Planting substrate - coarse beach sands 6-8 inches thick.
3. Northern exposure - limited sunlight.

B. Planting Procedure

1. Plants - delivered to White Marsh on May 26th.
    - a. Smooth Cordgrass (Spartina alterniflora)
      660 peat pots
    - b. Saltmeadow Hay (Spartina patens)
      150 peat pots
2. Planting Team - May 27th
    - a. S.C.S. - Ken Carter, Ed Scates.
    - b. S.E.A.S. - Jack Frye.

3. Row Pattern

    a. Smooth Cordgrass - 8 rows X 145 feet.
    planted at MHW on east end angling to 3 feet below MHW on westward.

    b. Saltmeadow Hay - 3 rows X 100 feet.

C. Mortality

1. Initial: 10-15% loss overall.

2. To date (8-1-81).

    a. Smooth Cordgrass - 90% loss.

    b. Saltmeadow Hay - 50% loss.

3. Remarks: most all (95%) of smooth cordgrass has turned brown and died. Saltmeadow Hay lost 60% those planted below MHW.

DISCUSSION

Criteria for success or failure of a given marsh grass planting will be relative to site conditions. Success versus failure of a planting follows a time continuum. The first phase of this continuum is the initial establishment of the plants. Of the 12 sites planted this year, two (Garret and Gill) were totally washed out, one (Tankard) was half washed out, and three (Mountjoy, Windmill Point, and Murphy) died off totally. The remaining six sites (Wellford, Durham West and South, Camp Chanco, Lee and Hickman) have a 50% or better survivial rate and the plants are green, healthy and growing well. Thus, a particular site's initial success depends on survivial.

The second phase of the marsh planting time continuum is maintaining the planting by fertilization and keeping it free of debris through the first and second growing seasons. The primary unknown factor which may damage or totally destroy the planting is the occurrence of severe storm activity. This factor will play a more significant role on medium and high energy shores.

Once the planting becomes an established marsh grass fringe, then the third phase of the time continuum would start in. This is the actual reduction of the erosion of the adjacent bank which was experiencing erosion before the planting. Reduction of bank erosion might commence after the first season. The time required for the stabilization of an eroding bank face will vary but this appears to be the ultimate end for a successful planting. A possible fourth phase of the time continuum will be how long the bank will remain stable. It may always be necessary to maintain the planting by fertilization and debris removal. It may also be that additional planting will be necessary after loss from storm damage.

As the VEC Project proceeds on its own time continuum, the numerous physical parameters will be evaluated so that the data base for marsh grass planting to abate erosion can be expanded and enhanced. The ultimate end of the project should result in criteria for the average landowner to establish his own marsh fringe inexpensively and with a certain amount of assuredness.

WILDLIFE FOOD AND COVER

Elaeagnus umbellata PI-421132 for Wildlife Food and Cover

34A009J

The results of previous evaluations for Elaeagnus umbellata (autumn olive) PI-421132 have confirmed its characteristics as being desirable for wildlife food and cover. Like other Elaeagnus (i.e. Cardinal) strains, it is considered an excellent conservation plant. Its vigorous fruit production is unique in that vegetative propagation is the only means of true reproduction. It differs from 'Cardinal' (PI-421800) by having a later fruit maturity date and possessing better leaf retention during the early winter.

Cardinal and PI-421132 were established in the spring of 1976 at fourteen planting sites. Five more locations were selected in the spring of 1977, one in 1978 and three in 1979. The locations are in Plant Hardiness Zones 5b to 9b. The plantings extend westward from New Hampshire to Oregon and from Michigan to Florida.

Survival of PI-421132 has been good with only five locations losing plants. Winter injury to PI-421132 has been severe in Michigan and New York (zone 5b). In Michigan, the topgrowth was killed back to the soil each year and all new growth has been from basal sprouts. A record cold temperature (-32°C) observed at Big Flats, New York killed the plants back to the soil line during the 1978-79 winter. The cold injury was so severe at both locations that PI-421132 was rated not adapted. The plantings in Michigan and New York have been eliminated from the study.

A 1979 planting in New Hampshire (also zone 5b) suffered only light winter damage to both PI-421132 and Cardinal. However, no fruit production was noted for Cardinal and only green fruit was observed on PI-421132 (first year fruit production) and this was not expected to mature.

In general, very little insect or disease damage has been observed on either accession. The amount of damage has been equally distributed between PI-421132 and Cardinal. In 1981, disease damage was reported only by Florida and this was reported as light. Mechanical damage, mostly by equipment, was reported by several locations.

Fruit production on PI-421132 was recorded at 9 locations excluding New Hampshire. Two locations observed no fruit production. In general, PI-421132 matures later and produces a greater quantity of larger fruit than Cardinal. The exceptions were at Georgia and Mississippi where Cardinal produced larger or equal sized fruit, although in lesser quantity; and at Tennessee where PI-421132 matured earlier. Birds have been observed eating the fruit. They seem to prefer Cardinal to PI-421132. At the Cape May PMC, birds first ate the fruit off Cardinal and then consumed the fruit off PI-421132 in less than a week. This is probably because Cardinal fruit matured earlier than PI-421132.

The original objective of this project was to determine the range of adaptation for PI-421132 and compare the performance between Cardinal and PI-421132. It has been determined that PI-421132 is probably not adapted in Plant Hardiness Zone 5b, but it appears to be adapted in 6a and southward. This late maturing Elaeagnus umbellata would have wider use in the south than in the northeast. Therefore, the Long Range Plan for PI-421132 has been revised to test its adaptation and use in the south.

Table 1

Four characteristics for two strains of Elaeagnus umbellata, 1981

Location	Year Estab.	Zone[1]	MLRA[2]	PI-421132 Sur. (%)[3]	PI-421132 Vigor[4]	PI-421132 Dim.[5] H x W	PI-421132 Dam.[6]	'Cardinal' Sur. (%)	'Cardinal' Vigor	'Cardinal' Dim. H x W	'Cardinal' Dam.
Missouri	1976	6a	115	100	E	3.5x3.7	N	40	F	3.8x3.4	N
Pennsylvania	1976	6a	147	60	E	2.8x2.2	N	40	G	3.1x1.8	N
New Jersey	1976	6b	149	100	G	3.4x5.0	N	100	F	3.0x3.7	N
Virginia	1976	7a	136	100	G	3.0x2.5	N	100	P	2.2x1.5	N
Cape May PMC	1976	7b	149	100	E	3.0x4.6	N	100	G	2.5x4.0	N
North Carolina	1976	7b	136	100	E	2.1x3.0	N	60	E	3.0x2.7	N
Tennessee	1976	7b	122	100	E	3.7x4.3	N	100	G	3.1x3.4	N
Mississippi	1976	8a	134	80	E	5.0x5.5	N	60	F	3.5x3.5	N
Georgia	1976	8b	133	100	E	5.0x7.5	N	100	F	4.0x4.0	N
Florida	1976	9b	154	100	E	4.0x4.0	L-D	100	G	4.0x3.0	L-D
Pennsylvania	1977	6a	147	80	G	2.3x1.5	N	60	F	1.8x1.2	N
West Virginia	1977	6b	127	100	F	2.0x1.5	N	100	F	2.0x1.5	N
New Hampshire	1979	5b	144	100	E	2.1x1.2	L-W	100	G	1.8x1.2	L-W

1/Zone = Plant Hardiness Zone.
2/MLRA = Major Land Resource Area.
3/Survival - Percent of living plants fall 1981; 5 plants established/accession/location.
4/Vigor - E=Excellent; G=Good; F=Fair; P=Poor.
5/Dimensions - Height x width; expressed in meters.
6/Damage - N=None; L=Light; D=Disease; W=Winter.

Table 2

Fruit characteristics for PI-421132 and 'Cardinal' *Elaeagnus umbellata*, 1981

				PI-421132				'Cardinal'			
				Fruiting Dates		Fruit		Fruiting Date		Fruit	
Location	Year Estab.	Zone[1]	MLRA[2]	Maturity[3]	Range[4]	Amt.[5]	Size[6]	Maturity	Range	Amt.	Size
Missouri	1976	6a	115	-	-	0[7]	-	-	-	0[7]	-
Pennsylvania	1976	6a	147	-	-	5	7x7	-	-	4	5x7
New Jersey	1976	6b	149	11/3	10/3-11/20	4.6		9/6	9/5-9/22	3.5	-
Virginia	1976	7a	136	-	-	-	-	-	-	-	-
Cape May PMC	1976	7b	149	10/19	11/10	5	-	10/1	-	3	-
North Carolina	1976	7b	136	-	-	4	-	-	-	1	-
Tennessee	1976	7b	122	7/15	7/1-8/30	5	7.5x8.8	9/1	8/1-9/1	5	6.3x7.5
Mississippi	1976	8a	134	11/6	9/30-11/13	5	6x7	7/20	7/15-8/20	3	8x5
Georgia	1976	8b	133	10/30	-	5	5x5	9/15	-	3	6x7
Florida	1976	9b	154	10/26	10/?-12/?	5	6x7	7/10	7/?-8/?	2	5x6
Pennsylvania	1977	6a	147	-	-	3	7x7	-	-	2	5x7
West Virginia	1977	6b	127	-	-	0[7]	-	-	-	0[7]	-
New Hampshire	1979	5b	144	10/27[8]	-	-	-	-	-	-	-

1/Zone = Plant Hardiness Zone.
2/MLRA - Major Land Resource Area.
3/Maturity - Date that a majority of the fruit was ripe.
4/Range - The date of the first ripe fruit and the date of the last ripe fruit.
5/Amount - The relative amount of fruit produced, the plant with the most fruit was rated 5 and all others relative to that production.
6/Size - Length and diameter of fruit expressed in millimeters.
7/No fruit observed.
8/Green fruit not expected to mature.

Table 3

Fruit and leaf retention for PI-421132 and 'Cardinal' *Elaeagnus umbellata*, 1981[1]

	PI-421132		'Cardinal'	
Date	Fruit Retention	Leaf Retention	Fruit Retention	Leaf Retention
10-19	100[2]	100[2]	30	60
10-28	95	90	30	5
11-3	95	80	20	5
11-10	75	70	20	T[3]
11-17	T[4]	50	T	
11-24		40		
12-1		35		
12-8		10		
12-15		10		
12-22		5		

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[1] Plants are located in Field 20 Cape May PMC.

[2] Percent remaining on tree.

[3] T=Trace, less than 5 percent.

[4] Slightly more fruit remained on PI-421132, the fruit seems to have been eaten by birds.

Herbaceous Plants for Wildlife Food and Cover

34A014J

Several herbaceous species are available for the establishment of vegetative cover on critical areas. While these species provide good erosion control, their wildlife value is limited.

Solid stands of erosion control species often tend to discourage rather than encourage the use of these areas by small game and birds. Wildlife requires plants for food, escape cover, nesting cover and travel lanes. A solid stand of one species will not provide all four elements for most wildlife.

Eight species of herbaceous conservation plants, which were considered as having some potential for wildlife food and cover, were used to establish a wildlife planting on May 8, 1979. Each plot was 7 x 16.5 meters and replicated three times in a randomized plot design. Single species of legumes and grasses were used. No maintenance of any type was performed beyond the establishment period.

Lespedeza thunbergii 'VA-70' (shrub lespedeza), *Eragrostis curvula* (weeping lovegrass) and *Festuca arundinacea* (tall fescue) exhibited the best stand 90 days after seeding. However, the wildlife cover value for *F. arundinacea* was providing excellent cover for small game and also had scattered seedheads located throughout the plot for food use. *L. thunbergii* also demonstrated excellent wildlife cover by the presence of tall erect stems and abundant green leafy foliage. *L. cuneata* (sericea lespedeza) 'Interstate' and 'Appalow' varieties both had fairly good stands, but wildlife cover value was rated better for Interstate due to its upright growth characteristics. *Panicum clandestinum* (deertongue), *P. virgatum* (switchgrass) and *Lathyrus sylvestris* (flatpea) had only fair stands during the 90 day evaluations.

In 1980, second year evaluations showed *F. arundinacea*, *E. curvula* and *L. sylvestris* as the best three for stand performance. Spring regrowth was also better for *F. arundinacea* and *L. sylvestris*.

Winter food for birds was rated high for *P. virgatum* and *L. cuneata* 'Interstate' due to the abundance of available seed both on the plants and ground. *L. thunbergii* provided the best fall cover for small game while *E. curvula* provided the best cover for the winter.

During the spring of 1981, one-half of each plot was mowed to a height of 4 inches. Regrowth was good for all species, however, *L. cuneata* and *P. virgatum* exhibited considerably better vigor during the summer and fall in the mowed area than in the non-mowed area. Seed production was also greater for these two species in the non-mowed area. *E. curvula*, *L. thunbergii* and *P. virgatum* continued to provide the best wildlife cover for all seasons. Winter food for wildlife was rated best for *P. virgatum* and *L. cuneata* Interstate.

An additional wildlife planting was established at the PMC in the spring of 1981. Plots were seeded to mixtures of various grasses and legumes to determine the compatibility of seeded wildlife species with erosion control plants. Despite the strong competition from annual weeds, the planting was successful in becoming established, however, vigor was reduced considerably. The plots which were seeded to a mixture of *P. virgatum*, *E. curvula*, and *L. thunbergii* appeared to be more compatible during the establishment period than any of the other mixtures.

The objective of this project is to improve the wildlife food and cover on critical areas which are seeded primarily for stabilization.

Herbaceous Plants for Wildlife Food and Cover, 1981[1]

34A014J

1979 Planting

Notes

Festuca arundinacea - Good stand but poor vigor. Appears to be suffering from drought. Providing very little wildlife food and absolutely no wildlife cover.

Panicum clandestinum - Good stand and vigor. Fair food quality with fair to good cover for small animals. Immature seed on plants. Rabbits were flushed from plots.

Eragrostis curvula - Very good stand and vigor. Providing little food but excellent wildlife cover. Few mature seedheads. About 5% of plot has winter killed. Rabbits were flushed from plots.

Lespedeza thunbergii - Excellent stand and vigor. Providing very little food at this time but excellent wildlife cover. Plants are in the bloom stage.

Panicum virgatum - Good stand and vigor. Providing a fair source of food and very good cover for birds and mammals. Plants have an abundance of immature seed.

Lathyrus sylvestris - Good stand with poor to fair vigor. Plants are providing little food value and almost no cover for birds and mammals. Entire plot appears to be diseased (yellowish brown leaves). Very few seed on plants.

Lespedeza cuneata 'Appalow' - The competition from other lespedeza species within the plots has drastically affected the overall vigor of 'Appalow'. Vigor and stand are rated poor to fair.

Lespedeza cuneata 'Interstate' - Very good stand with good vigor. Plants are providing very little wildlife food for birds and mammals. The cover effect is rated as fair.

[1] Plots were seeded on May 8, 1979; data recorded August 27.

Table 1

Evaluation for eight herbaceous wildlife plant species. 1981 1/
1979 Planting

Species	Winter Cover 2/ Birds	Winter Cover 2/ Mammals	Winter Food 2/ Birds	Winter Food 2/ Mammals	Percent Soil Cover 3/ Leaf Litter	Percent Soil Cover 3/ Plant Growth
			Rep I			
Lespedeza cuneata (Appalow)	8	9	7	7	60	30
Panicum clandestinum	5	7	8	5	40	70
Festuca arundinacea	7	8	8	6	15	95
Eragrostis curvula	1	1	7	7	70	95
L. thunbergii (VA-70)	7	8	7	9	80	25
L. cuneata (Interstate)	4	4	5	8	95	55
P. virgatum	1	1	3	8	40	80
Lathyrus sylvestris (Lathco)	7	9	9	6	50	95
			Rep II			
L. thunbergii (VA-70)	7	1	7	8	80	30
L. cuneata (Interstate)	5	3	7	6	100	60
P. virgatum	1	1	8	8	40	80
P. clandestinum	4	5	5	5	40	70
Eragrostis curvula	1	2	7	7	70	95
L. sylvestris (Lathco)	7	1	7	5	50	90
L. cuneata (Appalow)	8	9	8	5	50	30
F. arundinacea	7	8	5	8	15	95

Table 1
(cont.)

Evaluation for eight herbaceous wildlife plant species, 1981
1979 Planting

Species	Winter Cover		Winter Food		Percent Soil Cover	
	Birds	Mammals	Birds	Mammals	Leaf Litter	Plant Growth
			Rep III			
L. sylvestris (Lathco)	7	9	8	5	50	90
P. virgatum	1	1	5	8	40	85
F. arundinacea	8	9	8	6	15	85
L. cuneata (Appalow)	9	9	7	7	50	35
L. cuneata (Interstate)	4	4	6	8	95	50
L. thunbergii (VA-70)	7	8	7	9	80	25
P. clandestinum	5	6	8	7	40	65
E. curvula	2	2	7	8	65	95

1/Wildlife planting was seeded on May 8, 1979; data recorded Nov. 24.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

3/Percent soil covered by plant growth or leaf litter on a representative area of the plot.

Table 2

Evaluation for eight herbaceous wildlife plant species, 1981[1/]

Species	Stand[2/]	Vigor[2/]	Food[2/]		Summer Cover[2/]		Ave. Height (cm)
			Birds	Mammals	Bird	Mam.	
			Rep I				
Lespedeza cuneata (Appalow)	-[3/]	-	-	-	-	-	-
Panicum clandestinum	2	3	4	5	3	4	56
Festuca arundinacea	1	5	5	4	8	9	30
Eragrostis curvula	1	2	6	7	2	3	60
Lespedeza (VA-70) *thunbergii*	1	1	7	6	1	3	175
L. cuneata (Interstate)	1	2	8	6	3	4	90
P. virgatum	2	2	2	4	1	3	140
Lathyrus (Lathco) *sylvestris*	4	7	5	4	6	8	50
			Rep II				
L. thunbergii (VA-70)	1	1	7	6	1	3	180
L. cuneata (Interstate)	1	3	8	6	3	5	85
P. virgatum	2	2	2	4	1	3	150
P. clandestinum	2	3	4	5	3	5	67
E. curvula	3	4	7	7	3	4	60
L. sylvestris (Lathco)	5	7	5	4	7	9	45
L. cuneata (Appalow)	-[3/]	-	-	-	-	-	-
F. arundinacea	2	5	6	6	8	9	30

Table 2
cont.
Evaluation for eight herbaceous wildlife plant species, 1981

Species	Stand	Vigor	Food Birds	Food Mammals	Summer Cover Bird	Summer Cover Mam.	Ave. Height
			Rep III				
L. sylvestris (Lathco)	4	6	5	4	6	8	45
P. virgatum	2	2	2	4	1	3	135
F. arundinacea	1	4	6	6	8	9	30
L. cuneata (Appalow)	-3/	-	-	-	-	-	-
L. cuneata (Interstate)	3	4	8	6	3	5	75
L. thunbergii (VA-70)	2	2	7	6	1	3	160
P. clandestinum	3	4	4	5	3	5	65
E. curvula	2	3	6	7	2	3	70

1/Plots were seeded on May 8, 1979; data recorded August 27.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Dominance of plot by other *Lespedeza* species made evaluations impossible.

Table 3

Evaluations for nine herbaceous wildlife species, 1981[1]
Compatibility Planting

Species	Winter Food		Winter Cover		Stand	Soil Cover
	Birds	Mammal	Bird	Mammal		(%)
	Rep I					
Festuca arundinacea *Lathyrus sylvestris* (Lathco)	9[2]	8[2]	10[2]	10[2]	9[2]	15[3]
Eragrostis curvula *Panicum clandestinum* *Lespedeza cuneata* (Appalow)	9	8	8	9	8	20
F. arundinacea *L. cuneata* (Appalow)	9	8	9	9	7	30
L. cuneata (Interstate) *E. curvula* *L. thunbergii* (VA-70)	9	8	5	6	4	45
Lolium perenne *L. sylvestris* (Lathco) *P. virgatum*	7	8	6	6	4	45
F. arundinacea *L. cuneata* (Interstate) *P. virgatum*	7	8	6	6	4	45
F. arundinacea *L. thunbergii* (VA-70)	9	8	9	9	6	25
P. virgatum *E. curvula* *L. thunbergii* (VA-70)	6	7	3	4	2	85
L. perenne *P. clandestinum* *L. thunbergii* (VA-70)	9	8	10	10	8	10
F. arundinacea	9	8	9	10	7	25
L. perenne *L. thunbergii* (VA-70)	9	8	10	10	9	5
Eragrostis curvula *P. clandestinum* *L. cuneata* (Interstate)	9	8	4	4	4	55

Table 3
(cont.)

Evaluations for nine herbaceous wildlife species, 1981 Compatibility Planting

Species	Winter Food Birds	Winter Food Mammal	Winter Cover Bird	Winter Cover Mammal	Stand	Soil Cover (%)
	Rep II					
L. perenne L. sylvestris (Lathco) P. virgatum	6	8	3	3	3	85
F. arundinacea L. cuneata (Interstate) P. virgatum	6	7	3	4	3	80
F. arundinacea	9	8	9	9	5	50
F. arundinacea L. cuneata (VA-70)	9	8	9	9	5	50
F. arundinacea L. sylvestris (Lathco)	9	8	9	9	6	50
F. arundinacea L. cuneata (Appalow)	9	8	9	9	6	45
L. cuneata (Interstate) E. curvula L. thunbergii (VA-70)	9	8	5	5	6	55
E. curvula P. clandestinum L. cuneata (Appalow)	9	8	2	3	2	85
P. virgatum E. curvula L. thunbergii (VA-70)	8	8	2	2	2	85
L. perenne P. clandestinum L. thunbergii (VA-70)	9	8	10	10	-	30
E. curvula P. clandestinum L. cuneata (Interstate)	9	8	3	3	3	80
L. perenne L. thunbergii (VA-70)	9	8	10	10	6	35

Table 3
(cont.

Evaluations for nine herbaceous wildlife species, 1981 Compatibility Planting

Species	Winter Food		Winter Cover		Stand	Soil
	Birds	Mammal	Bird	Mammal		Cover
Rep III						
P. virgatum E. curvula L. thunbergii (VA-70)	9	8	7	8	7	40
F. arundinacea L. thunbergii (VA-70)	9	8	8	7	4	40
L. cuneata (Interstate) E. curvula L. thunbergii (VA-70)	9	8	9	8	8	25
F. arundinacea L. cuneata (Appalow)	9	8	8	7	4	40
L. perenne L. sylvestris (Lathco) P. virgatum	9	7	9	9	5	35
E. curvula P. clandestinum L. cuneata (Appalow)	9	8	9	8	8	25
F. arundinacea L. cuneata (Interstate) P. virgatum	9	8	8	7	4	35
F. arundinacea L. sylvestris (Lathco)	9	8	9	8	5	25
F. arundinacea	9	8	9	9	6	25
L. perenne L. thunbergii (VA-70)	9	7	9	9	7	20
E. curvula P. clandestinum L. cuneata (Interstate)	9	8	8	7	6	40
L. perenne P. clandestinum L. thunbergii (VA-70)	9	7	9	9	6	35

1/Rep I and II were seeded on June 5, 1981; Rep III was seeded on June 8, 1981; data recorded November 24.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None

3/Percent of soil covered by plant growth on a representative area of the plot.

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SEED AND PLANT PRODUCTION

1981 SEED PRODUCTION

No.	Name	Origin	Hectares	Production(kg) (bulk)
PI-78758	*Andropogon caucasicus*	-	3.2	211
PI-421136	*Panicum amarum* var. *amarulum*	VA	1.6	452
'Blackwell'	*P. virgatum*	OK	Nil[1]	1.7
PI-421138	*P. virgatum*	NC	0.8	22.7
PI-431575	*P. virgatum*	KY	Nil	0.7
T-27003	*Spartina alterniflora*	NJ	Nil	0.9
'Lathco'	*Lathyrus sylvestris*	WA	3.2	107
'VA-70'	*Lespedeza thunbergii*	Manchuria	1.4	113
'Rem-Red'	*Lonicera maackii*	MD	.04	15.8
'Arnot'	*Robinia fertilis*	NY	.09	5.3

1/Production areas less than 0.02 hectare are recorded as Nil.

1981 PLANT PRODUCTION

No.	Name	Origin	Hectares	Production (number)
'Garrison'	Alopecurus arundinacea	-	Nil[1/]	260
T-14666	Ammophila arenaria	-	Nil	2,600
'Cape'	A. breviligulata	MA	.09	86,050
T-02688	Carex arenaria	NC	Nil	1,975
PI-433953	C. kobomugi	Japan	Nil	2,225
PI-421132	Elaeagnus umbellata	PA	Nil	96
PI-348865	Elymus arenarius	Belgium	Nil	800
PI-316233	E. arenarius		Nil	1,850
PI-421134	E. vancouverensis	MA	Nil	2,730
T-2692	Juncus balticus	MA	Nil	800
'Emerald Sea'	Juniperus conferta	Japan	Nil	210
" "	" " cuttings	"	Nil	1,000
T-02927	Leersia oryzoides	OH	Nil	800
T-02739	" " -	NJ	Nil	800
'Rem-Red'	Lonicera maackii	MD	Nil	1,040
T-02747	Myrica cerifera	NJ	Nil	370
PI-434159	M. pensylvanica	NJ	Nil	440
T-02773	Panicum amarum	NC	Nil	3,100
'Kents'	Phalaris arundinacea	IL	Nil	350
PI-254903	P. acuatica	-	Nil	260
PI-434199	" "	-	Nil	260
'Rise'	" "	MO	Nil	1,000

1981 PLANT PRODUCTION
(cont.)

No.	Name	Origin	Hectares	Production (number
PI-434204	*Phragmites australis*	TX	Nil	800
T-02781	" "	NJ	Nil	800
T-02789	*Scirpus americanus*	NJ	Nil	800
T-02792	" "	DE	Nil	800
Various accessions	*Spartina alterniflora*	-	Nil	1,325
PI-421238	*S. patens*	NC	.02	6,676
PI-434390	" "	NJ	.02	11,640
PI-421612	*Tripsacum dactyloides*	KS	Nil	260
T-02823	" "	NJ	Nil	260
T-02824	*Typha angustifolia*	MD	Nil	260
T-02825	" "	NJ	Nil	260

1/Production areas less than 0.02 hectare are recorded as Nil.

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ENGLISH-METRIC CONVERSION

Conversion Table

1 inch	=	2.54 centimeters (cm)
1 foot	=	30.48 centimeters
1 yard	=	91.44 centimeters
1 pound	=	0.454 kilogram (kg)
1 acre	=	0.405 hectare (ha)
1 pound/acre	=	1.121 kilogram/hectare
1 bushel	=	0.352 hectoliter
100 centimeters	=	1 meter (m)
1 centimeter	=	0.394 inch
10 centimeters	=	3.94 inches
1 meter	=	39.37 inches
1 kilogram	=	2.205 pounds
1 hectare	=	2.471 acres
1 kilogram/ hectare	=	0.892 pound/acre